The Builder.

Vol. L. No. 2243 — Saturday, February 13, 1886.

ILLUSTRATIONS.

Liverpool Cathedral Competition: View in Choir.—Design by Messrs. G. F. Bodley & T. Garner, Architects 270
Liverpool Cathedral Competition: Centre West Portal.—Design by Messrs. G. F. Bodley & T. Garner, Architects 271
Section through Nave looking East, of Messrs. G. F. Bodley & T. Garner's Design for Liverpool Cathedral 274-275
Longitudinal Section, looking North, of Messrs. G. F. Bodley & T. Garner's Design for Liverpool Cathedral 278-279
The New Exchange Buildings, Cardiff.—Messrs. Seward & Thomas, Architects 282-283

CONTENTS.

Discoveries at Winchester Cathedral 259
Report on Sewer Ventilation 260
Notes 261
Cathedral Façades 263
Edinburgh Architectural Association 265
Technical Education for Artisans in Ireland 265
The Proposed Cathedral at Liverpool 266
Old College Buildings, Glasgow (Illustrated) 266
British Archæological Association 267
Royal School of Mines 267
Liverpool Cathedral Designs 267
The New Exchange, Cardiff 268
St. Paul's Cathedral Approaches (with Plans) 285
The Principles of Domestic Fireplace Construction 285
Timber Measurement 287
"Plumbers and Parliament" 287
New By-Laws for Concrete Building in the Metropolis 287
The Student's Column: Foundations.—VII. 288
Church-Building News 288
Recent Patents 289
Recent Sales of Property 289
Meetings 289
Miscellanea 289
Prices Current of Building Materials 291

Discoveries at Winchester Cathedral.

FOR some time to come the attention of architectural students and antiquaries may be with advantage devoted to certain works of some magnitude which are now being carried out at Winchester Cathedral by the Dean, aided by his colleagues, and supported by local subscriptions.

It will be remembered by many of our readers to whom this famous cathedral is known, that it occupies the southern side, so to speak, of a large open area, planted more or less with trees, the most conspicuous of which form the fine shaded avenue which leads almost direct from the high street of the city to the main western door of the sacred pile. This open area has a perceptible slope citywards down to the north side of the cathedral, and a cursory inspection only a short time since would have convinced an ordinary spectator even that a great amount of earth had been allowed to accumulate along nearly the whole length of the building. At the west front, too, the ground is more or less uneven, giving the appearance to the path as if it had been cut through the soil to receive its recent level, while some curious remains of walling opposite the west front had a buried look plainly telling of the rising of the ground. This aspect is no creation of recent years, for it was noted at the beginning of the last century by Dr. Milner, who spoke of the ruins referred to, to refute the then asserted belief that they were the remains of a portion of the church said by tradition to have been built by the ubiquitous King Lucius in Roman times!

Old views of the cathedral also show the extent to which the ground had risen, for the singular Norman doorway which opened externally on the west front of the north transept is shown as being covered well up to the springing of its semicircular arch.

The Dean's work is altering all this buried appearance. A body of excavators have been at work for many weeks removing the earth from the cathedral walls down to the original level, and also making many improvements in the somewhat dreary expanse of open ground already referred to, many judicious works of planting and re-arrangement being carried out at the same time. The benefits are threefold: not only is the building kept free from the damp rising from the accumulated earth, but its appearance is greatly enhanced. Fully 4 ft. of earth have been already removed from a great portion of the walls, the effect of which is to materially increase their apparent height, of essential benefit since the design of the cathedral is so long for its height.

In addition, the kindly feeling which has prompted the carrying out of these works at the present time of distress and scarceness of work, is beyond all praise.

This open ground on the north side has always been spoken of by old writers as the ancient cemetery of the cathedral, remarkable for the erection in it, in Saxon times, of another large monastic church side by side with the cathedral, and called, in contradistinction, the New Minster. The existence of two churches close together is a matter of much curiosity, since it is so different to that of a parish church adjacent to a monastic minster, or to the grouping of several small detached chapels around it; both of which arrangements are common enough, and readily explainable from the usage of the times. To have in a city two large monastic establishments at some little distance from each other is not unfrequent, particularly on the Continent, but an instance of it may be cited at Canterbury, where St. Augustine's Abbey was at no great distance from the cathedral.

Here, however, a few feet only divided two large churches parallel to each other. The appearance must have been not unlike that which exists in our own day at Erfurth, where two fine churches are placed so close together as to present an architectural group of great interest, although the benefit of the position may be open to question.

The old records are precise enough as to the state of things which existed here at Winchester, as well as the earlier events attendant upon the foundation of the monastery. Thus we are told by Ingulph, Leland, and others, that the intention of founding was King Alfred the Great's, although it appears by earlier chroniclers that the completion of the work was effected by his son King Edward the Elder, the year 903 being named in the Saxon Chronicle as the date of the consecration.

King Edward translated the remains of Alfred and his Mother, Queen Alswitha, into the church immediately after its completion, and it appears to have been his intention to place St. Grimbald, the Frankish mass priest, over the establishment of secular canons attached to the church, but his death took place in the year of consecration. The dedication was to the Holy Trinity, St. Mary, and St. Peter. We learn from William of Malmsbury that the site was so valuable that a mark of gold was paid for every foot of ground upon which the building was erected, while Radbourne states that the site extended to 1,884 ft.,—whether in length or in area is not very clear, but the former may be supposed, particularly if the return boundaries be included. King Edward's charter tells us that the area consisted of three acres and three virgates, and we learn from this document what is mentioned by the writers already quoted, that King Alfred planned the foundation of the church and partly executed it, the completion and endowments being Edward's.

Evil days were in store for the monastery. Its occupants took the side of King Harold. Twelve of the monks and twenty soldiers followed their Abbot Elwy, who was a brother of Earl Godwin's, to the field of Hastings whence they never returned. The displeasure of William the Conqueror against the abbey was felt for many following years, and the more so since the king was close at hand. He appears to have erected a palace at the north-west of the cathedral, probably on the site of that of the early Saxon kings, this being, perhaps, included in the vacant ground remaining to be excavated. The further history of New Minster closes, so far as its original position is concerned, by a record of its being taken down and removed to the Hyde meadows in 1110, or 1111, as the date is given by various chroniclers. At this time the relics of King Alfred and his queen were removed to the new church, where they remained until they were scattered by spoilers apparently in recent years, long after the dissolution. The cause of the removal is tersely stated. It was the disaccord between the occupants of the two Minsters. The bells of one were rung while service was going on in the other; the choral services themselves interfered with those in the adjacent church; and we are constrained to believe that the occupants did not possess any of the blessedness promised to those brethren who dwell together in unity.

The knowledge that the site of King Alfred's foundation was covered by the accumulated earth close to the cathedral naturally prompted the Dean to have some tentative excavations made, with the view of testing the accuracy of the old records. Accordingly the ground was trenched northwards from the cathedral. At a distance of 26 ft. 5 in. from the north transept the workmen came upon a massive wall, about 4 ft. in thickness, and 3 ft. below the ground. This was soon found to be of considerable extent, running parallel with the north wall of the cathedral, and justifying the belief that it was actually the southern wall of King Alfred's church. This belief is most probably correct. The wall has been traced eastward, and uncovered for about 70 ft. or 80 ft. in length, and it is found to continue for the whole of its extent of the same uniform appearance and thickness. Following its course

westward, it is found to return at right angles, as if for the west front of the building; but here only the rough concrete of the foundations, about 10 ft. below the present level of the ground, are to be met with. This has been followed for about 25 ft., but the termination has not yet been reached. The wall is solidly, but roughly, built of local rubble, put together with fairly good mortar. There are numerous fragments of Roman brick built up in the wall, and the excavators have found a great quantity of Roman pottery and brass coins, mostly of the later emperors. The workmen are still at work on this most interesting site, the intention being to follow the indications of the walls from end to end, with the view of recovering the entire ground-plan. This work is likely to prove of considerable value; for, apart from the interest derived from opening up to view the outline, so to speak, of King Alfred's foundation, the importance of having revealed to us the actual design of a Saxon minster of large size cannot be over-estimated in relation to the history of art.

The results of the excavations along the north wall of the cathedral are of considerable interest. The ancient plinth of the building has been exposed to view entirely around the north transept. As is well known, this transept is the work of Bishop Wakelyn, the first of the Norman bishops, who rebuilt the cathedral entirely. The exact date is well recorded, for we hear of the beginning of the work in 1079, and its completion in 1093, in which year the monks removed from their old monastery to the new one thus prepared for them, the shrine of St. Swithin being brought into the new church. On the following day the demolition of the old one began and was completed within the year, except one porch and the great altar which were left standing. The work is, therefore, amongst the earliest which the Normans erected, and it is a valuable study. Its roughness and entire absence of ornament give no little reason to the belief for so long a time held by the antiquaries of the beginning of this century that this portion of the cathedral was of Saxon and not Norman date. Increased knowledge of Early Norman work enables us now to recognise in it all the characteristics of this date, while we may in this same building trace in the works which brought it to completion the modification of the Norman style by the introduction both of ornament and moulding. Interesting as the study of the work has always been, it is now greatly enhanced, for the walls are now seen standing on their original base, which is as perfect as when laid by the old masons 800 years ago. The base consists of a boldly-chamfered plinth, which extends from point to point of the principal projections and does not break around the smaller pilaster buttresses. The old masonry is in perfect condition, having the diagonal tool-marks which are so sure a sign of Early Norman work. The joints are wide and the stones are of the moderate size so usually found at this period.

The work is very similar to Lanfranc's work at Canterbury, so far as it remains at the latter cathedral; the original plan of these two Norman buildings, which were in progress at the same time, having many points in common. One illustrates the other, and with the advantage that what is lost by removal at Canterbury exists at Winchester.

On removing the earth accumulated around the door in the west wall of the north transept, it was found to be of good proportions, and to go down to the plinth level. It has now been entirely cleared. The position of this door is remarkable. A doorway of Norman date exists on the west side of the south transept of the little cruciform church of Old Shoreham; but it is to be doubted if one in this position exists in any other cathedral. Much speculation has been occasioned as to its use; but may it not have been to give a direct entrance to the Norman king and his court? If the old tradition is correct, that the palace was to the north-west of the cathedral, its position would be one of necessity. The excavators were rewarded in an unexpected way during the progress of their work at this point. On removing the rough filling-in of the doorway, two or three charming pieces of sculpture more or less broken were found. Attention being called to these discoveries, more of the walling was taken down, and fragment after fragment came to light. These consist of heads and portions of the figures of saints, carved with remarkable delicacy and skill. There is one figure with a hand upon a book; another with the name Dorothy, in old English spelling, and many others. Several fragments of architectural panelling have been met with, and a singular portion of a Purbeck marble column worked in the form of a twisted knot. These fragments show clearly enough the fate of the numerous shrines which once adorned the cathedral, while the remains of the figures account for the many vacant niches, which are apparent in the chantry chapels, which have been preserved to our time almost uninjured.

The excavations in the crypt will, it is hoped, be the most interesting portion of the work, the intention being to remove the whole of the accumulated earth. This crypt, apparently entirely of Wakelyn's work, is one of the most interesting of our early crypts remaining. At present it is encumbered with about 3 ft. or 4 ft. of earth, either placed there to prevent the rising of water or for purposes of convenience. A trial hole was made some time ago, and the base of one of the massive circular columns was found at the depth named. This was watched for some months, and no water having been found to percolate into it, it is considered that the excavations can be continued with safety, the main drainage of the city, recently accomplished, having, it is hoped, brought about this happy result. The increased appearance and effect to be given to this fine crypt, by nearly 4 ft. being added to its height, is expected to be very great; while the bringing open to view the whole height of the columns, and their curious early bases, will render the work of additional importance as an example of the earliest Norman work extant.

The progress of the excavations, too, may be expected to reveal some ancient features at present buried. The grave of Prior Silkstede has already been brought to light.

REPORT ON SEWER VENTILATION.

THE Report of the Special Purposes and Sanitary Committee to the Metropolitan Board of Works, on sewer ventilation, reminds one that there is no finality in sanitary matters more than in other branches of science. It is only a very few years since charcoal disinfectors or filters were to do everything for us in the way of disinfecting and purifying the air escaping from sewers and drains, and now the charcoal system is reported on all hands as practically a failure, not because charcoal will not in the first instance perform what was promised for it, but because it soon becomes saturated with the moisture in suspension in the sewers, and loses its deodorising power, and the constant changing and reburning of it would be too troublesome and costly in a large system of sewerage. The Report charges against charcoal also, on the ground that the placing of a charcoal tray in a ventilator amounts to closing that ventilator. This can hardly be said to apply to the arrangement which has been tried at Croydon, and, we believe, elsewhere, of a spiral series of trays, between which the air was passed, so as to afford contact with the least amount of mechanical obstruction. This system is reported as having been tried at Croydon for ten years (the charcoal being replaced every three weeks), and finally disused on account of the difficulty of keeping the charcoal dry, and therefore efficient, and also "because it obstructed the ventilation of the sewers"; but we cannot think there can be much in this latter objection in the case of the spiral trays arrangement. The charcoal tray, with only a passage for the air by percolation between the particles, is, of course, another matter, and is, undoubtedly, a serious obstruction to ventilation.

The Report is a rather rambling and unpractical document. It assumes the possibility, for instance, of the majority of householders in a district entering into a covenant to flush the drains simultaneously, at stated intervals, so as to do it with more effect,—an idea which suggests a very imperfect acquaintance with human nature from the householder point of view. The principle is also suggested that a householder is morally bound to be a kind of sewer ventilation agent, even to the extent that if he puts in an intercepting trap, he ought to be bound to supply a ventilator to the sewer to compensate for the loss of the former ventilation into his own premises. There is a touch of unintentional satire, what may be called sanitary satire, in this, which is rather amusing. On the other hand, the householder who was formerly content to draw the sewer air directly into his house, as a part of the order of nature, has now, under the influence of the preachers of the gospel of sanitation, become so wary that he kicks obstinately against the proposals of the Board to carry up ventilating pipes from the sewers against the walls of his house to a point above the roofs. The caution of the householder, under his present sanitary education, is not to be wondered at; that it may be carried too far, however, is shown by the answers to questions scheduled in the Appendix, where, in reply to the question "Have vertical shafts or pipes been used in your district for ventilating the local sewers?" the Vestry of St. George's Hanover-square reply that the prejudice against them is so great that it could only be done in isolated cases, and that in one case where such a pipe was put up, the occupier of a house in another street, who could see this pipe from his windows, complained in the strongest manner of the nuisance occasioned by it, and the danger to his family, and threatened legal proceedings, long after the pipe, though still visible, had been disconnected from the sewer!

The Report groups the possible methods of ventilating sewers under three heads:—(*a*) Surface ventilation by shafts leading from the crown of the sewer to the surface of the road; (*b*) by large separate shafts, factory chimney-shafts, and smaller shafts, in all of which fire or other heat is the motive power; (*c*) by pipes or shafts without heat. In regard to system *b* it is perfectly effective, but, unfortunately, the great cost it would entail in the erection of chimney-shafts and in fuel would place its general adoptien in a large sewerage system out of the question, and the utilisation of the heated current of factory shafts, besides that such shafts are not numerous enough and are not always where they are wanted, is met with the same difficulty as that just touched on in regard to the shafts up the sides of buildings,—the great objection of most owners of factories to allow their shafts to be utilised in that way. The conclusion of the committee is that this system can only be usefully applied, with proper regard to economy of cost, at a few points in a system where there are special difficulties of ventilation or special cause for desiring very efficient ventilation; and this is the only reasonable conclusion that can be come to on the evidence.

In regard to ordinary pipe ventilation, this has been tried to a greater extent than many persons are aware of, generally to mitigate the nuisance arising from ventilating openings in the roadway. It is stated by the Commissioners of Sewers that 137 pipe ventilators have been constructed in the City, but that these "have not helped materially in reducing the nuisance from surface ventilators. In twenty-two out of thirty-seven other districts in the metropolis, pipe ventilators have been to some extent used, and the total number of such ventilators provided by the local authorities in London appears to be 582, of which Lewisham has 149, the City 137, and Wandsworth 100. In twelve districts the pipe ventilators are reported as having abated nuisance, especially when used in connexion with surface ventilators. In five districts the pipe ventilators, it is stated, have not abated nuisance. Fulham states that the pipes have not materially abated nuisance, as in certain atmospheric states they are inoperative. St. Saviour's,

Southwark, states that the ventilating pipes had to be abolished, as they were a nuisance to the inhabitants."

In Bethnal-green and in the Strand district it was impossible to obtain the consent of the owners of property to the erection of pipe ventilators, and Hampstead and St. James's state that they can give no decided opinion whether such ventilators have abated nuisance. Lewisham has the largest number of pipe ventilators of any district, but the report from that district gives no certain opinion, only observing that "where the surface ventilators have been removed the complaints have of course ceased."

In regard to surface-ventilation the efficacy depends upon the number, size, and construction of the ventilating-shafts, and the general evidence taken on this head points to the conclusion that in many cases these are too few and far apart, and that nuisance would be diminished by increasing their number, and thus dividing the up-draught and rendering it loss concentrated. The distance from each other at which the ventilating-shafts are placed varies in different parts of the metropolis from 17 yards to 600 yards. Twenty-nine districts report that it would be advantageous to increase the number of surface-ventilators, reporting variously in favour of distances of 20 to 50 yards apart, 60 to 80 yards, 80 to 100 yards, 100 to 150 yards; and one district says "not less than 200 yards apart." It may be taken as the result of present evidence that it is better to have a considerable number of ventilators in a given length than to have them at long distances apart; the possible nuisance in the latter case occurs at fewer points, but it is considerably intensified at those points.

Now it must be observed that the Report fully recognises the indubitable fact that one of the principal causes of nuisance arising from sewers lies in want of sufficient water-carriage and consequent stagnation. Having admitted this, and having stated that "the Committee are of opinion that the first and most important matter in connexion with sewers is the provision of water for flushing the sewers in dry seasons," it is somewhat surprising to find that in another part of the Report it is seriously proposed that the Board should apply for Parliamentary powers for the compulsory erection of pipe-ventilators in connexion with houses and other buildings. This is one of the examples of the illogical character of the Report. It is admitted that the only advantage of pipe-ventilators is to remove the effluvia further out of reach; that such ventilators, unaided by heat, act no better for their main purpose than surface ventilators (the evidence seems to show, as might be expected, that in some states of the weather they may be even less efficient); that pipe ventilators would be a real source of danger or annoyance to the occupants of houses unless they can be kept at a considerable distance from windows and other openings; and that the main cause of there being any nuisance at all is insufficient flow; and yet with all these admissions the Committee propose to apply for powers to compel the erection of pipe-ventilators. We venture to think that, on the evidence of their own Report, they have no chance of obtaining such powers, and that they are unnecessary and might be very liable to abuse.

A confusion of ideas seems to have dictated also the paragraph in regard to the conditions of temperature in sewers and its effect on the ventilation. "When the temperature of the air of the sewer is lower than that of the external atmosphere, and no other influence is at work, the colder atmosphere of the sewer, being heavier than the external air, remains in the sewer; but when the outer air becomes colder and consequently heavier than the air in the sewer, it presses down through some of the openings to the sewer, and drives out the warmer and lighter air through other openings. This is noticeably the case on cool evenings in hot, dry seasons, at which time the nuisance from sewer ventilators is probably at the worst. It is, therefore, necessary to provide in sewers as, in all other ventilation, inlets for the cold air as well as outlets for the warmer air." Considering that in this case the flow is assumed to be sometimes one way, sometimes the other, it is probable that the air will make its own inlets and outlets; but perhaps for the greater convenience of the air, the committee would have the ventilators labelled, like the approaches to a railway booking-window, "In" and "Out."

Again, after having distinctly stated that the real desideratum for preventing nuisance is sufficient and rapid water-carriage, the Committee, nevertheless, proceed to enlarge in their report on the value of permanganic acid for deodorising the contents of the sewers in hot weather; whereas what is really needed, according to their own showing, is an extra supply of water. In fact the report gives the idea of having been compiled by several persons, each with his own idea of the best treatment, which he takes opportunity to enforce in his own special paragraphs.

As to the question of the provision of ample water-carriage, the Report alludes to one method of using water in dry weather, so as to make it do double duty, for cleansing above and flushing below. "In the summer months the paved surfaces of the whole of the courts and alleys in the Holborn district are periodically washed with water taken from the company's mains. In this way not only are the surfaces of the courts and alleys kept clean, but the sewers below are well flushed out also." The Committee think that, if a similar course were taken in other districts, a large part of the nuisance from sewer-gas would be removed, in addition to the sanitary benefit in other respects. This is one of the most practical suggestions in the Report. In general, the difficulty of adequate and frequent flushing, or of keeping up a full and rapid flow in the sewers in dry weather, is in the cost of the water. Special means for the storage of rain water, to be used for adding to the volume of water in the sewers when requisite, seems the most practicable alternative. The initial cost would be considerable, but it might prove economic in the long run. In violent storms the sewers are nearly choked with water, and get well flushed at the time; but if the water thus allowed to run away could be stored and distributed for more frequent use, it would be turned to much fuller advantage.

Generally, the conclusions to be gathered from the facts stated in the Report are that a more rapid flow and a greater number of surface ventilators would almost entirely remove the sewer-ventilator nuisance, and that the rest of the recommendations in the Report are not much to the purpose, and in some cases almost cancel each other.

NOTES.

THE recent case of M'Lachlan and Cuckson *v.* Grant, in which an architect and a surveyor sued a lady for a sum due to them for taking out quantities, would not have been noticeable except for the judge's observations in regard to the payment of architects. For as to the merits of the case it was simply a dispute as to the amount due. But Baron Huddleston expressed, as has often been done before, his opinion that the way in which architects are remunerated by the payment of five per cent. on the total cost of the work is very unsatisfactory. He also expressed a wish that the Royal Institute of Architects would take the matter into their consideration. Of course there are low-class practitioners among architects as among lawyers, and in each profession these members of it will run up bills unnecessarily against their clients. But it is as unreasonable to suppose that the bulk of the profession overcharge their clients as it would be to say that the bulk of solicitors make up improper bills. On the other hand, there is no doubt that the existing method of remuneration prejudices the architectural profession in the eyes of the public, and inclines them to dispense as much as they can do with the services of architects. In principle the system is not a good one, for the plans of a house which costs 2,000*l.* may be as troublesome as those of one which costs 4,000*l.* It may be observed, however, that the Institute of Architects has really no more power than the Incorporated Law Society has on its part to fix the amount of remuneration due to its members. Any architect may charge by a fee, instead of by 5 per cent., if he pleases.

IN the same case referred to above, Baron Huddleston also went out of his way to remark that he should hold, until he was overruled, that an architect has no right to employ a surveyor to take out quantities without the consent of his client. This was a purely gratuitous piece of information, inasmuch as the question of the employment of a surveyor did not arise in the case, the only point being the amount of commission to be charged for the quantities. It may be as well for the learned Baron to inform himself as to former decisions on the subject; and if he will turn to Scott's Reports, vol. vi., p. 1, he will find that his opinion is opposed to that of four judges, namely, Chief Justice Tyndall, Justice Parke, Justice Collier, and Justice Bosanquet, who held that an architect has the right and power, without notice to his clients, to pledge his employers' credit to a surveyor for the quantities, and that in so doing he is acting as their agent (Moon *v.* The Guardians of Witney Union). There was another case (Wright *v.* Attenborough), in the Court of Exchequer, before Mr. Baron Martin, of a similar character, in which the plaintiff recovered (*Builder*, vol. xiii., p. 489).

IN reference to the construction of the dome in Mr. Emerson's design for the Liverpool Cathedral, which is, we believe, admittedly adopted from that of the tomb of Mahmoud at Beejapoor, and the Jumna Musjid at the same place, a correspondent writes:—"Careful measured drawings of the tomb of Mahmoud and other buildings in Beejapoor have been made by Mr. Cumming, C.E., under the superintendence of Capt. Hart. They are published in a folio volume, entitled 'Architecture at Beejapoor' (John Murray, London, 1866), and are well worthy of careful examination. The book is in the library of the Royal Institute of British Architects. Whilst writing the above, may I venture to ask what the plan is of the intersecting arches in Mr. Emerson's design? They surely must be in a vertical plane as in the two Indian examples, and cannot follow the curve of the dome. The interior perspective published in your journal seems to show the latter; for the wall immediately over the great arches is circular. This would be an impossibility, for the intersection of the eight great arches must form an octagon in plan. A triangular soffit is thus left between the octagon and the circle, which is covered in the Mahmoud tomb by placing brackets of varying projection underneath (see plan). If Mr. Emerson's dome were carried out, surely the walls and balustrade immediately over the pendentives would have to be octagonal, with the circular dome springing from behind, unless the same expedient of placing corbels under the soffit were adopted. In either case the internal effect would be materially altered."

A POINT of some interest has been decided in the recent patent case of Otto *v.* Steel, in which the question of the novelty of the invention of the well-known gas motor engines was raised. One of the objections to the novelty was that Otto's invention had been anticipated in a treatise by a Frenchman named Beau de Rochas. The only publication of the work, using the word publication in the legal sense, was that in 1863 a copy of the book was placed in the library of the British Museum. But Mr. Justice Pearson held that there was not a sufficient publication to invalidate a patent. It was not published (again using the word technically) in such a way that there was a reasonable probability that any person who wished might get knowledge from it. It had not, in the opinion of the judge, become

"part of the public stock of common knowledge." Of course, in each separate case it must be a question whether a book has become part of the public stock; but English inventors will, at any rate, derive comfort from the knowledge that their inventions are safe, although some foreign work which contains the same idea is reposing on the shelves of the British Museum.

AN international competition is advertised in the Italian papers for a design for a new west front to the cathedral at Milan. No fewer than fifteen premiums are offered, of a total value of 3,000*l.* The designs will be adjudicated upon by a jury of architects of different nationalities.

MR. HICKMAN, M.P., speaking at a meeting of the Wolverhampton Chamber of Commerce, on Friday last, gave his opinion as to the causes of the successful German competition in the iron and steel industries. He considers that one reason for the low prices of German manufactures is the low rate of wages and the longer hours made by the operatives of that country. They have another great advantage in the railway rates, which the speaker declared to be even lower than stated in the report to which we alluded in our article on this subject last week. He strongly favoured the proposal to construct a canal from Birmingham to London, for steamers of 120 tons burden, expressing his opinion that the cost of conveyance would thus be reduced 50 per cent. Several other canal schemes are being promoted, and the competition between land and water conveyance is likely to be carried on more vigorously than ever in both directions. Mr. Hickman brought a strong charge against the railway companies for excessive charges, and the preferential rates in favour of foreign produce in October, 1884, and a writer in the *Railway Official Gazette* of that month, commenting upon his paper, made the following remarks:—"Obviously the rates need revision, as the heavy traffic from the hardware districts is being carried in a much greater degree than heretofore by means of the canals; and, without taking a gloomy view, it is far from unlikely that on many such waterways steam haulage will set up a real and fresh competition with our railways, which it will be difficult to again completely overcome." Another thing which cannot be without significance to the companies is the removal of works to the ports, with the avowed purpose of avoiding the heavy railway charges. Messrs. Nettlefold, for instance, have now officially confirmed the report that they are about to remove their extensive steel and wire works to Newport, Monmouthshire, on this account.

WITH regard to the recent lamentable accident at Holloway (see p. 252, *ante*), we are glad to see that the recommendation of the coroner's jury, to the effect that the Metropolitan Board of Works should endeavour to obtain powers enabling the District Surveyors to supervise the demolition of old buildings as well as the erection of new ones, was brought before the Board at its last meeting, and referred to the Building Act Committee for consideration and report. Attentive observers must often have felt the necessity for more adequate precautions in the conduct of demolitions, and this not only in the interests of the public at large, but for the safety of the men engaged in this often dangerous work.

THE celebrated arcade, called the Galleria Vittorio Emanuele, at Milan, designed by the late Professor Mengoni, and opened in 1867, has (according to *Il Politecnico*) fallen into a lamentable state of dirt and disrepair, and it is in consequence proposed to restore it. A discussion has arisen as to whether the original elevation of the interior shall be retained, substituting stone or some similar material for the plaster and cement in which the original design was executed, or whether a new and more simple design should be adopted for the interior in order to avoid future deterioration of the surface from dust and damp. The Milanese Society of Engineers and Architects recently passed a resolution to the effect that the Society was persuaded of the urgent necessity of a permanent and complete restoration of the arcade, and expressed the hope that such restoration should be carried out on the principle that the present architectural and decorative features should be respected as far as possible, introducing only such changes in the materials and workmanship as will, without altering the character of the building, render the interior façade absolutely durable and secure, and facilitate its being maintained in a simple and economical manner.*

AN ingenious means of making good damage done by water getting under a lock-floor, without using coffer-dams and laying dry the dock, has been successfully tried on the Zuid-Beveland Canal, and is quoted in the "Foreign Transactions" published by the Institution of Civil Engineers. The lock in question rests on a pile foundation, supporting a timber floor on which the brickwork walls are built. The natural soil consists of fine running sand. For some time the earthen backing to the lock walls was found to be giving way, and considerable silting up had taken place in the canal bed, just outside the lock chamber. A hole was found in the apron of the lock floor, and there was a hollow underneath the floor itself. This was at first filled with puddled clay, but it had all been washed out again shortly after, and the sinking of the ground continued. Coal tar was then pumped down through a tube near the apron, at the upper side of the lock-chamber. This passed under the floor to the lower side, showing that continuous hollows existed under the lock-floor. An unsuccessful attempt was made to fill these by forcing down water and sand. It was then discovered that the timber piling was attacked by teredo worm, and that even the floor was not free from it. In 1882 it was determined to fill the hollows with concrete, of one part Portland cement to five parts sand. Eight holes were bored through the lock-floor, and the concrete was forced down through a tube so as to completely fill the space between the original soil and the underside of the floor. Thirty-seven mètres cube of concrete was the quantity used, and this formed a hard mass underneath the floor. The traffic was only closed about seven weeks, and the cost of the work amounted in all to 177*l.*

THERE were 786 kilomètres of new railway opened for passenger traffic in Germany in 1885 against 875·5 kilomètres in 1884 and 916 in 1883. Of these, 580 kilomètres were State railways and 206 kilomètres were in private hands. The increase for the year is about 2¼ per cent. on the length of lines previously open. The net return on the German railways averages 4·3 per cent. per annum, the co-efficient of working cost being 57 per cent. It will thus be seen that the main aim and outcome of the German lines is the facilitation of transport. The average cost of a mile of German railway is about 21,234*l.*, against 42,017*l.* for a mile of railway in the United Kingdom. The gross receipts of the German lines amount to 10 per cent. on capital against 9·15 per cent. in the United Kingdom. But the Saxon railways, constructed at about the same average cost per mile, earn 11·9 per cent. gross revenue, and net 5·1 per cent. on capital.

ACCORDING to the official Year-Book of the Church of England, the funds raised by the voluntary contributions of societies and institutions organised and administered by the Church of England alone, during the last twenty-five years, amount to the large sum of 81,570,000*l.* This does not include bequests and voluntary offerings of which the Church of England is only a partial receipient, in conjunction with other religious bodies. And there is a large contribution from private sources which it has been impossible to bring into account. Out of the sum above stated, no less than 35,175,000*l.*, or upwards of 42 per cent., has been devoted to church building and restoration, building of parsonage-houses, enlargement of burial-grounds, and endowments of benefices. From this sum all grants from church societies and corporations are excluded. The published return does not divide the total under the heads above given. But however large be the allowance due to the last two heads, the allocation of a sum probably considerably in excess of a million sterling per annum to the purpose of building and restoration is certainly a matter of interest to both the architect and the builder.

THE accounts of the London and North-Western Railway Company, of which the published receipts for the half-year showed a decrease of revenue to the amount of 110,000*l.*, on a total of 5,000,000*l.*, show a balance sufficient to admit of a dividend at the rate of 7 per cent. per annum, against 7½ per cent. for the corresponding part of 1885, and 8 per cent. for that of 1884. The Great Northern Railway, with an increase of 26,000*l.* on a revenue of a little under 2,000,000*l.*, maintains its dividend, at the rate of 6 per cent. per annum, declared for the corresponding half of the previous year. The Great Western Railway Company, with a decrease of 105,000*l.* on a revenue of 3,600,000*l.*, divide at the rate of 6½ per cent. per annum, against 7 per cent. at the corresponding period of 1885; carrying forward a balance of 40,000*l.* instead of one of 35,400*l.* The accounts of the North London Railway Company show a balance sufficient to admit of a dividend at the rate of 7½ per cent. per annum. With these railway dividends should be compared the generally prosperous accounts of the tramway companies, and the 10 per cent. per annum dividend, with 1*l.* 5*s.* per cent. bonus, free of income tax, of the London General Omnibus Company.

EXTENSIVE changes are taking place in Rome. The embankment of the Tiber is being continued; the extension of the Via Nazionale to the river is being carried out, as well as the new street uniting the Via Angelo Custode with the Corso. This latter street, when finished, will make a continuous and nearly straight line of communication between the Corso near the Piazza Colonna and the new Spithœver quarter and the new buildings at the Ludovisi and the Porta Pia. A new workmen's quarter is in progress at Monte Testaccio, a locality which will be remembered by students in connexion with the German artists' festival. Extensive building operations are also going on outside the Porta Pia, on the Prati di Castello and on the waste ground between the Lateran and the Church of Sta. Maria Maggiore, which are rapidly changing the aspect of these parts of the city.

IN the last number of the *Revue Critique* M. Homolle gives an account of the results of the new explorations carried on at Delos. We are glad that the glory of completing what years ago they began is to belong to the French Government. The remains of a Mediæval city have been laid bare, and the discoveries in the field of classical archæology, though not so sensational as those of the previous enterprise, are still full of interest for the history of the "island schools." Fifty fragments of marble sculpture have been found, besides terra-cotta and small bronzes. To these have to be added 224 fragments of inscriptions, some dating as early as the fifth century B.C., none later than the first century B.C. They contain funeral inscriptions, dedications, decrees, and choragic lists. One of them is six hundred lines long, and the whole, when edited, are sure to throw much light on the politics and commerce of the Cyclades. One individual monument we must note, a sculptured vase, signed by the maker Iphikatides of Naxos.

THE excavations carried on in the Roman arena at Paris have just been rewarded with very interesting results. An artificial watercourse in excellent preservation has

* Interior views of the building were published in the *Builder* for April 25, 1868, and February 4, 1882; and a view of the entrance was published in our pages on July 4, 1868.

been laid bare, which evidently served the purpose of filling the circus with water on the occasion of mimic sea-fights. Enough of the structure of the door-posts remained to show that the entrance was closed by a door of extraordinary strength, which would indeed be needed to stem the force of the water. The hole which held the door-hinge is clearly made out. The excavators have further come upon a number of the seats for the spectators, and also on some fragments of a slab on which were inscribed the names of the dignatories,—inhabitants of the ancient town of Lutetia, who had a right to seats of honour.

THE *Kölnische Volkszeitung* reports also an important Roman discovery. Within the precincts of the Roman castrum at Bonn a bronze statue of a "Victory," standing on a globe, has been found. The type is already familiar, the style of the workmanship is reported as belonging to the best Roman period. With the statue was found a splendid gold medallion set with rubies. Both of the discoveries are now in the private collection of Professor Weerth at Bonn.

THE collection of drawings by Mr. Herbert Marshall at the Gallery of the Fine Art Society, illustrating "the Scenery of London," is one of the most admirable and interesting of the smaller exhibitions now open. Mr. Marshall's fine and pure style in water-colour is known to all who are interested in contemporary art, and the subject of the picturesque of London architecture he has almost made his own, combining a fine sense of effect with a knowledge of architectural forms such as is not often found among painters who deal with architectural subjects. It is true that here and there we find drawings in which the attempt at special effect has rather obscured the truthfulness of the view. For instance, we should not at a glance have recognised the view entitled "South Kensington" (67) as a representation of the precise point selected; it does not convey the impression of the place at once; and the same may be said of a few (but only a few) others. Among those which are particularly good as combining effect with local truth are "Emmanuel Hospital" (18), "Lambeth, Early Morning" (19), "Whitehall" (21), "The Approach to Westminster" (24), "St. Giles, Cripplegate" (28), and "Sunrise in Broad Sanctuary" (84). A very effective drawing is that of "The Tower and River from Wrightson's Warehouse" (64), giving a point of view not, of course, familar; looking over the tower and the river from a height. "St. Bartholomew the Great" (85) is a view specially interesting at the present moment. The collection shows how much of picturesque grouping exists in London, and on every ground it is an exhibition which none who are interested in London architecture, and in good and sound water-colour art, should miss seeing.

SIG. GIACOMO BONI, a young Venetian architect, whose researches with regard to the foundations of the campanile of St. Mark at Venice were recently noticed in these pages, has been recently elected a Corresponding Member of the New York Academy of Science.

SIR JOHN SAVILE LUMLEY, the British Ambassador at Rome, delivered a lecture on the 26th ult. before the British and American Archæological Society at Rome, on the Galley of Tiberius on Lake Nemi, the

"Nemi navell'd in the wooded hills"

of Byron, and the scene of Ernest Renan's romance "The Priest of Nemi." Frequent attempts have been made to discover the remains of the galley or ship or floating island, which is traditionally reported to have been sunk in a storm, but the only result has been pieces of timber, tiles, enamelled plates, and nails, which have been brought up from time to time by the divers employed. The lecture was well attended, and was received with frequent applause.

AT Messrs. Dowdeswell's Gallery in Bond-street is a collection of water-colour drawings by Mr. James Orrock, illustrating "the country of Scott," on the English and Scottish Border. Mr. Orrock's style is rather limited in its range of effects, but he possesses, as we have remarked before, a special gift in the representation of atmospheric effect under certain conditions: his rainy skies are full of rain and wind, his sea-coast scenes smell of the sea. A great deal of his characteristic power is illustrated in this collection of drawings.

WE have received from Mdme. Palladiense, of New Bond-street, some very excellent reproductions of pictures and studies of cattle by Verboeckhoven, an artist whose animal paintings are full of character and power of drawing.

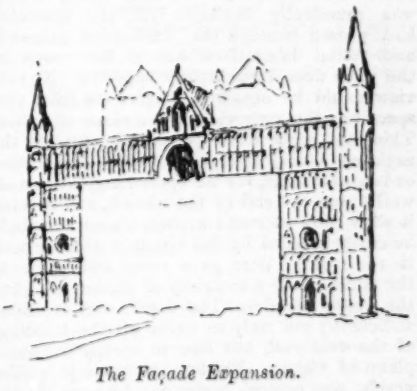
IN reference to the elevation of Sir Edmund Beckett to the peerage, the *Times*, in giving its usual short biographical sketch of the new peers, after mentioning some things for which Sir Edmund Beckett is justly distinguished, adds "and he is an authority on ecclesiastical architecture." This extraordinary statement has been copied into newspapers all over the country. We presume the gentleman who does this work for the *Times* wishes to be accurate. It is a pity that he did not inquire from some authentic source of information before making this statement. Sir Edmund Beckett is not and never was an authority on ecclesiastical architecture. No person who does understand the subject would care a button for his opinion on it. His reputation in this respect rests solely upon the fact that he writes letters to the *Times* asserting that he is an authority, and that a number of dunces are silly enough to believe him.

CATHEDRAL FAÇADES.*

THE rapid glance that we have taken at the work of these architects will enable us to realise the huge burden of originality which is expressed in the façades of our three English examples at Lincoln, Peterborough, and Salisbury. We will consider Lincoln first, as the fact that we see the front crowned by twin towers may seem to give it some points of comparison, though not of likeness, with the French façades; and, further, because it is certain that the designer of Peterborough, and probably also the Salisbury architect, observed and studied the Lincoln building.

The Norman Front of Lincoln.

The original west front of Lincoln Cathedral was built in Norman times by Remigius, and consisted of five semicircular arches of graduated heights; four of them remain as they were built; the centre one, which corresponded to the section of the Norman nave, having been replaced with a pointed arch when the front was expanded. The two outermost arches cover apsidal recesses like huge niches, and deeply recessed beneath the three central arches are the celebrated doorways, unrivalled at home for the delicacy and beauty of their sculpture. A little above these doorways the piers are crossed by a frieze of most interesting Early Norman bas-reliefs; but beyond this the front exposed its sternly bare walling up to the delicate ornamental arcade above the arches. Then came three enriched Norman gables, which were returned to the north and south, where they still exist behind the screen; and above all rose the two very beautiful later Norman towers, dedicated to St. Mary and St. Hugh. This original front must have formed a charming and picturesque group with its quaint disposal of plain and ornamental surfaces, bold light and shade, picturesque gables, and beautiful towers. The architect who would disturb all this must be bold to audacity, and possess some loftier and new ideal to replace this most satisfactory early front. The cathedral as we now see it was built from St. Hugh's choir westward, seemingly a tacit acknowledgment to the claims of the front to preservation; and though wider than the nave of Remigius it was still thought best not to disturb the west end, but complete the work against the eastern faces of the towers. Thus a bay of the Norman nave has been left between the towers; but the vault was rebuilt at a greater height, and with it, the central arch of the front. Two large and beautiful chapels were erected in the position of western transepts on either side of the nave, thus adding width to the front. When these works were completed, it was decided, in the episcopate of the celebrated Bishop Grostête, that the Norman front, with all its impressive beauty, was not of sufficient scale and grandeur for the cathedral now in contemplation; but the front was too good and too well loved to be pulled down and replaced; and thus it remains to us, a striking instance of the preservation of an ancient building by those ruthless destroyers of historical monuments, the unrivalled architects of the thirteenth century; an exception to all their known methods of procedure.



The Façade Expansion.

The architect, whose was the task of dignifying the west front of Lincoln Cathedral, set about his task without hesitancy or fear; he conceived that this was an occasion which released him from all bonds of known precedent. The cathedral was practically complete, and a front had to be added commensurate with its importance. If he ventured to remove or efface the ancient front in obedience to his instincts, displeasure and perhaps dismissal would ensue. So, instead of enriching and decorating the bare Early work he decided to build upon and around it. He first removed the Norman gables covered with a curious diamond pattern that crowned the arches in front of the towers, and reared upon the delicate intersecting arcade, another of his own period, of very fully developed Early English design. This arcade reached up to the base of the new nave roof, and finished beneath a string that surmounted the central arch. The nave roof was terminated by a very fine enriched gable, and from its base line a massive Decorated parapet extended northwards and southwards in an unbroken horizontal line to the turrets which bound the façade. From behind this parapet the Norman towers, their faces covered with delicate arcading, almost piteously peeped, scarcely rising to the height of the gable that mushroom-like had sprung up between them. The architect's *coup de main* had reduced them to mere cyphers in the composition, as his façade was to consist of a central gable and long horizontal parapets of the severest outline, terminated by great octagonal turrets. The towers were not wanted in his ideal, and though not destroyed, were for a time extinguished.

Here we must remark what is an interesting Nemesis, if the architect had no ulterior intention of raising the Norman towers. Bishop Grostête also prepared the base for a magnificent lantern, two exquisite stages of which only are his work, and there he had to leave it. The

* Continuation of a paper by Mr. A. Beresford Pite read at the meeting of the Architectural Association on the 29th ult. (see p. 251).

next architectural generation raised upon it the unrivalled central tower, to complete the composition of the cathedral, which now possessed, besides the façade, the angel choir. There can be little doubt that such a lantern as this was conceived at the same time as the façade, though delayed an epoch in its execution. But did the architect dream that the spirits of those Norman towers of St. Hugh and St. Mary, whose light he so rudely sought to extinguish in days gone by, would again rise from behind his screen, drawn upwards from their sleep to the honourable and necessary function of balancing his now realised central tower? For we find that the erection of the elegant Perpendicular belfries upon the Norman towers followed the completion of the lantern, re-asserting their importance and dignity above the façade. This, we are conscious, is not detrimental to the success of the composition. An original designer is often apt to over-insist upon the emphasis of his particular idea, and Grostête's architect seems to have been so convinced of the power and dignity of an unbroken horizontal sky-line as to have overlooked the demands of the completed building for an imposing western group.

The circumstances of site and manner of approach are important considerations in façade design, and must here be dealt with. Lincoln Cathedral is situated on the edge of a great cliff, to which it presents its south elevation, and from which no direct approach can be gained. There was sufficient open space at the eastern end of the building to insure proper perspective for its grouping; but at the western end the precinct boundaries are close upon the church. No gradual view could be obtained of this front, which was practically invisible till the spectator had passed beneath the Exchequer gateway, and found himself within a few yards of the nave door, immediately opposite. No side view could be obtained to give the front perspective; the only view was a sheer elevation. This fact must have powerfully directed the architect's ideas to a façade without perspective or large features, for he spread a great curtain wall across the end of the church, and covered it with rows of small arches, whose size could be easily grasped by the eye, and whose repetition in regular tiers gave relief and leisure to the mind, while a company of statues enriched the upper arcades. The façade was expanded sufficiently not only to cover all the buildings of the west end, but also to occupy the whole plane of vision. Neither the transept, galilee porch, nor central tower can be seen till the corner of the front has been passed. The great width of the façade is a very interesting matter for thought, for other reasons besides those which we have just been considering. It was probably determined to obtain as good a proportion as possible for each half of the front, as it was only viewed from its central axis. All its horizontal lines between the parapets and ground are divided at the central recess. Each half of the façade is, therefore, proportioned to itself; but the entire expanse is too long, and requires the central group of towers and gable to give it dignity.

Though vastly differing in effect and treatment from the Lincoln front, the façade of Peterborough Cathedral is connected with it by such strong links, and by so many important points of resemblance, that the former might at first sight be thought to be the prototype of her neighbour, both in idea and execution. The resemblances, as we shall see, point distinctly to a close study of the Early Norman front of Remigius at Lincoln, and have but few points and qualities in common with the contemporary work of the thirteenth century. The architect of Peterborough Cathedral west front, shares many sympathies with the early Norman designer. They both appreciate the power of lofty arches, and the poetry of their continuous lines; both love the mysterious shades of the recesses, and also value the rhythm and lightness of the repeated crowning gables; both throw their façades forward in front of their buildings in an unbroken plane, obtaining grouping and distance, as well as massiveness and grandeur, by raising towers in the rear; both men also return gables against the north and south sides of the towers. These evidences of the appreciative study of successful Norman work by the thirteenth-century architect are most interesting, and mark him as a man with a truly great mind. With his work before us we feel that the designer of the Peterborough façade was possessed with the loftiest order of genius; his conception stands alone in its mysterious, solemn impressiveness; the mind never seems to tire of trying to unravel the secret of its poetry and grace. Is it not idle to call it unrivalled? All through the ages till now men have wisely kept out of the lists of its competition, and left it alone in solitary wonderfulness. The genius of similar capacity has not yet appeared or can be looked for; and if the designer of Peterborough had conceived another façade, would not his genius have led him to leave this work unrivalled? Lofty architectural conceptions are not to be produced nowadays, by the reproduction of great ideals already attained, but only by following the instincts of the heaven-bestowed measure of the gift of design. Let not the beholder think the great arches possess the secret of success alone, for the spirit of Peterborough will laugh his arches to shame. If he would have arches for arches' sake, let him go to Rome and copy Caracalla's Baths, which he may be able to understand better than those of Peterborough.

Among the grounds upon which we can compare the west front of Peterborough with Lincoln, is its site and manner of approach. The cathedral precincts are reached through a gateway central with the front, from which it is separated by a square enclosed green. On entering, the eye is immediately filled with all the extent and glory of the façade; the suddenness of the *coup d'œil* is in astounding contrast with the stately sublimity with which this wonderful façade rises out of the earth; we are filled with an exciting enthusiasm for the triumph of the poetry of its arches over the prose of walls, and are charmed with the graceful lightness of its crowns of pinnacles and gables, and of towers and spires which set at nought the restraints of the horizontal line. Compare these effects with those obtained by the Lincoln designer of this period, where, when facing the building, he sought with huge breadth of wall and severe simplicity of line to impress the beholder; for the contrast is complete.

The striking beauty of pointed arches of great size in full view, can scarcely be appreciated when seen in the single span of a cathedral vault, or in a nave arcade, however lofty, as only one arch is completely viewed at a time. For this reason we can partly account for the special interest of the central pointed arch in the Lincoln front, which is displayed in an open field of wall. The magnificent Pointed arch in the centre of the Peterborough façade is such a one as would span the nave, the width of which is reproduced in its piers, enriched with all the beauties of thirteenth-century mouldings, bands, and carving. We must not stay to speculate upon the reasons which here determined that the Norman nave should be retained, and all effort concentrated upon the façade,—exactly the opposite counsel to that which prevailed at Lincoln. We are contented, though probably the architect viewed the lumpy old Norman nave which he had to retain with jealous contempt, for, instead of being restricted within the narrower confines of internal nave architecture, this supreme genius was set free to build the façade, and in so doing he has amply revenged himself upon the Norman nave.

The peculiar qualities and mysteries of nave architecture have been bestowed upon this façade. Observe the lowering shadows of his nave arches cast across the narrow side aisle walks upon the walls beyond, behind which rise the towers external to this nave; the clustering shafts and piers of his grand crossing arches: the refined internal surface arcading and doorways, in his aisle walls; the lofty, graceful windows inclosed in delicate interlacing arches; and the very perfect groining;—all the beauties of nave architecture are here, in hitherto unattained grandeur and scale, while the vaulting shafts spring up with pinnacles and spires to the blue vault of heaven.

We must now hurriedly pass on to the west front of Salisbury Cathedral, which resembles the later work of the Lincoln façade, being a curtain wall flanked by turrets; the nave gable is brought on to the centre of the front, and alone breaks the horizontal sky-line. The architect was, however, entirely without any restraint of site, the ample precincts offering unequalled opportunities for varying groups and piles, of which the best advantage was taken on behalf of the central spire, round which the building most beautifully groups. This fact makes the reason for the choice of a façade for the west front, a matter of some mystery. There was no foreshortened building to be hidden, as the cathedral has no important direct road in front, nor was there ruder work to be surpassed or adapted. The façade is practically contemporary with the whole scheme, and must have been adopted from purely fanciful reasons. The fact that the arcades have been filled with sculptured figures can scarcely be taken as an indication that opportunity was required for such a display, which could only be afforded by a façade; for we do not find that the arches and niches are designed specially for this purpose, as a glance at the Lincoln tier of arches shows. The end of the nave is brought fully to the front with a majestic gable, great triplet window, and porches below which give direct access to the nave; and buttresses are placed on each side to resist the thrusts of the nave and triforium arches. Half arches spring from the outer shafts of the triple window to the buttresses. Large windows light the side aisles, and also have repeating halves that penetrate the buttresses, and above each of them are two windows to light the triforium. Within the simple and dignified lines of this façade, we find a most extraordinary freedom reigning, that must be called licence. As far as possible all continuous lines have been broken up, though the front is not in any way recessed; neither the great band of diamond ornament, or any of the arcades connect the wings of the façade with each other, and there are definite variations in the setting out of the arcades to prevent vertical lines from ruling the composition; the necessary buttresses which we have observed are covered by the arches, niches, and sculptures, so that when seen in façade elevation, their vertical lines should be as unobtrusive as possible. The very bold and striking band of quatrefoils inclosed in diamonds is broken at the centre bay, and a portion suddenly appears above the window, to be broken up again over the middle arch. The arcades which enrich the turrets are allowed to return into the wall anywhere, and anyhow, as if all points of view except the front were occasions for recklessness. The side aisle windows are allowed to break up the magnificent band of figures, which would have brought the whole front together, and done much to heal its weaknesses. The details are as beautiful as any other work of the thirteenth century; but there is such a loss of rhythm and continuity of line that we are inclined to think it all wasted. And the windows, too, which light the interior, seem, by their repeating arches, to desire to share the work of covering the front with arcades.

The two methods of façade design which came under our notice in considering the three French cathedrals, reappear at Salisbury,—viz., the proper expression of the interior of the building upon its exterior, and the desire to take advantage of the opportunities of producing grand and imposing façades by the freer use of architectural forms. Purely imaginative design inspires the later work at Lincoln, which transformed the front into a façade, and is the motive of the whole Peterborough design, where the architects' courageous treatment of their respective fronts released them from the duty of incorporating the internal arrangements with their façades. But at Salisbury this powerful handling was lacking, and the successful French method of compromise apparently unknown or unthought of; with the result that we find the elements at war. The imaginative parts of the architect seem to cry pitifully, "See what we would have done if we had fair play. These nave windows,—how they have broken up our boldly-designed band of diamond and quatrefoil ornament! These aisle lights,—how they split up our family array of figures into mere handfuls! And these wretched buttresses,—how they tumble up and down to the disturbance of everything!" And, almost dog-in-the manger-like, we hear the voice from interior remarking that "If they want a façade they must manage it without interfering with my comfort." And this hopeless discord will go on till the façade is pulled down, or, as there is too much light for the interior, the windows blocked up.

We must conclude our consideration of the subject by taking leave of Salisbury as an instructive example of the difficulties and dangers attendant upon the design of a cathe-

dral façade; which must deepen our appreciation of the tact with which the French architects arranged the difficulties of their fronts into successful compositions, and stimulate our enthusiasm for the bold originality, and the fine imagination, with which the architects of Lincoln and Peterborough stepped away from all hindrances, and triumphantly erected their magnificent cathedral façades.

The President, in opening the discussion, said that although the subject was one not at all easy of treatment in a short paper, yet Mr. Pite had handled it in a very thoughtful and critical manner. The first point touched upon was the effect of the central tower, which gives the utmost importance to the general design. In the case of Durham and Lincoln, one saw the combination of commanding position and of happy design; while in the case of Salisbury or Gloucester there was poor position for the cathedral, with excellent outline. Winchester, again, was poor both in general lines and position. There, it must be admitted, however, that Wykeham never finished his work, or he might have put a large central tower to balance the composition. The fact remained that at a short distance from the town, the cathedral, though large, was quite lost. The west front of Winchester was, perhaps, the simplest form of elevation-design that could be found, the lines of the sloping aisle and nave roofs being exhibited in the façade in a commonplace way. Lincoln, Peterborough, and Salisbury possessed, however, real *façades*, which had practically little to do with the buildings behind them. They were there for architectural effect and their own impressiveness. He believed they were all agreed that the west front of Peterborough was the finest in England. With regard to Salisbury Mr. Pite was right in what he said. From the eastern point of view it could not be called satisfactory, and the detail was not worked out in anything like a masterly manner. The west front of Wells Cathedral, although, perhaps, designed too much with the one view of giving a large field for the sculptor, was, at the same time, beautiful and suggestive. Tewkesbury and Dunstable were examples worthy of study. Turning to foreign façades that of Strasburg Cathedral stood foremost in the mere impressiveness of its first effect upon the spectator. At the same time they could not do better than accept Mr. Pite's opinion, that the best west front they could possibly study was that of Notre Dame.

Mr. W. J. N. Millard thanked Mr. Pite for showing the members his method of study, not bothering himself with the details, but going right to the root of the matter, and finding out the original design. It was uncommon for young students to take so broad a view of the subject. He proposed a vote of thanks to the lecturer.

Mr. Leonard Stokes, in seconding the vote of thanks, remarked that he had been rather struck by one point in the paper. Mr. Pite, on a former occasion, came to the conclusion that the plan of Peterborough Cathedral looked best upon paper when hung up on end. Now, however, the conclusion had been arrived at that Peterborough west front was the finest of any English Cathedral, and he agreed with Mr. Pite that it was a long way beyond any of the others in conception and completeness of scheme. He was afraid that Mr. Pite was going to praise Salisbury, which to his mind was hardly satisfactory. Notre Dame, on the other hand, was most satisfactory, the old architecture owing much of its beauty to the effect of the horizontal lines displayed in the design.

Mr. H. W. Pratt thought that Mr. Pite had brought this old subject before them in a somewhat new light. He had done well in limiting his remarks to three French and three English cathedrals. Great stress had been laid upon the west front of Peterborough, the effect of which, on passing through the gateway was that of vastness, leaving eventually the impression that there was a want of skill about it when looked at in connexion with the rest of the building. It seemed, therefore, a mistake to place the façade of Peterborough before the student as an example of what a west front should be. He did not know whether Mr. Pite considered it legitimate to design buildings in confined situations as façades, or in open situations where they could be seen all round, treating the façade as a façade in itself. When one had roamed about Italy, and seen how much the façade was thought of, and how shabby the back part was, one got sick of the fine fronts. He should be sorry if any one went away with the idea that in designing large buildings, he should study the main front so much, and not the perspective, the grouping, and the success of the building lines. In Gothic work the *raison d'être* was to keep the whole thing together, and not have one part independent of the rest of the building, while the exterior should represent not only the interior, but also the plan. In the case of Notre Dame the horizontal bands being carried straight through the façade, seemed to cut off the upper part of the towers from the building, and he rather preferred the carrying up of the vertical lines of the towers from the bottom. At Salisbury Cathedral the bands were not carried right across the façade, but still the effect was very good, as the connecting lines were carried across sufficiently by the eye.

Mr. F. G. F. Hooper remarked that Mr. Pite, in his treatment of the subject, had taken him by surprise. He thought that questions would have been raised with regard to the balance of parts, the fenestration, proportions of the doorways, and so forth. The illustrations before them contrasted strangely with each other with regard to the proportions of the doorways, and it would be an interesting matter for discussion to compare the several entrances. It had been said that the doorways of Notre Dame were like the entrances to bee-hives, and these were in contrast to the three grand arches of the west front of Peterborough.

The resolution was then put, and very cordially received.

Mr. Pite, in returning thanks, asked if he was stating something awful in saying that no great architect had really accomplished a grand imaginative work without having what was called a "sham" in it? He did not like the term "sham"; it was a miserable word. To call the façade of Peterborough Cathedral a "sham" was positively intolerable. In spite of Mr. Pratt's special pleading, he could not agree with him as to the west front of Salisbury Cathedral. It was too much to say that the towers of Notre Dame were cut off, as they were in one plane with the rest of the front.

EDINBURGH ARCHITECTURAL ASSOCIATION.

THE usual fortnightly meeting of the Association was held, on the 4th inst., in the Professional Hall, the President, Mr. G. Washington Browne, in the chair. After the usual preliminary business, Mr. Simon read a paper on "Woodcarving, with special reference to Germany." Remarking that the art had been practised from the earliest ages, he proceeded to trace its development from the rudely-carved handles of implements in the stone age, and of its application to domestic utensils in the ages immediately succeeding that. According to Pausanias, the statues were carved in wood, and this material continued to be so employed down to the Middle Ages, many examples still remaining in the cities of Germany, France, and England; but the art has long been applied to the interior decoration of churches, houses, furniture, &c Referring to Germany, where it had reached its fullest development, especially in the numerous afterpieces of the fifteenth and sixteenth centuries, Mr. Simon observed that of the various schools, the Swabian claims pre-eminence, with Ulm as its chief centre, where the celebrated carvers, Jörg Syrlin, the elder and younger, executed numerous beautiful works, especially the choir stalls in the Cathedral of Ulm, Augsburgh, also an important seat of this school. Its influence spread far into Switzerland and Bavaria. The lecturer referred to the works of Michael Pacher in Austria, and those of the celebrated Veit Stoss. The latter belonged to the Nüremberg school, but for a while was resident in Krakow, in Poland, where he executed a large altar-piece in the cathedral between 1477 and 1484. Other masters of this school were then mentioned, with a notice of medallion portraits executed in wood; some of them, of great merit, being in the Louvre in Paris; and the hope was expressed that the art may yet be restored to the place in public estimation which it formerly occupied. At the close of the meeting, a hearty vote of thanks was awarded Mr. Simon for his paper.

TECHNICAL EDUCATION FOR ARTISANS IN IRELAND.

IN a "Note" a fortnight ago (p. 192) reference was made to the mention by Mr. Philip Magnus at the Plumbers' meeting of the useful work which has been carried on in Dublin for some time past by Mr. W. R. Maguire. By a coincidence, Mr. Maguire read a paper on "Technical Education for Artisans" at the general meeting of the Institution of Civil Engineers of Ireland, held in Dublin on Wednesday, the 3rd inst. The paper included a comprehensive view of what has hitherto been done at home and abroad in the way of providing technical education for artisans. "Real technical education" was defined by Mr. Maguire to be "that which applies the principles of the natural sciences to the practice of the mechanical arts and industries connected directly with the future careers and occupations of the students." The following extracts from the paper have special reference to the needs of Ireland in this matter:—

"It seems to be most important to the future prosperity of Ireland that facilities for technical education, in the industries suited to our circumstances, should be offered to all who may be competent to profit by it, that our country may be given a supply of properly-qualified technical teachers, and that a more abundant and suitable supply of young people may be presented for technical training.

In any scheme of technical education for artisans in Ireland, there may be five grades or sections properly defined for consideration and arrangement:—

1. Primary education outside, but leading up to the point were lads of fourteen are fitted to commence a course of technical training.
2. Daily secondary technical education for persons who can afford to devote time for two or three years to a complete system of technical education, to fit them as foremen, managers, builders, with use of laboratories and workshops.
3. Evening technical education for apprentices and artisans engaged at their work by day, with lectures, and use of laboratories and workshops.
4. Technical art education, as applied to manufactures.
5. Higher technical instruction for employers, managers, and technical teachers, with lectures, demonstrations, and opportunities for original research in laboratories.

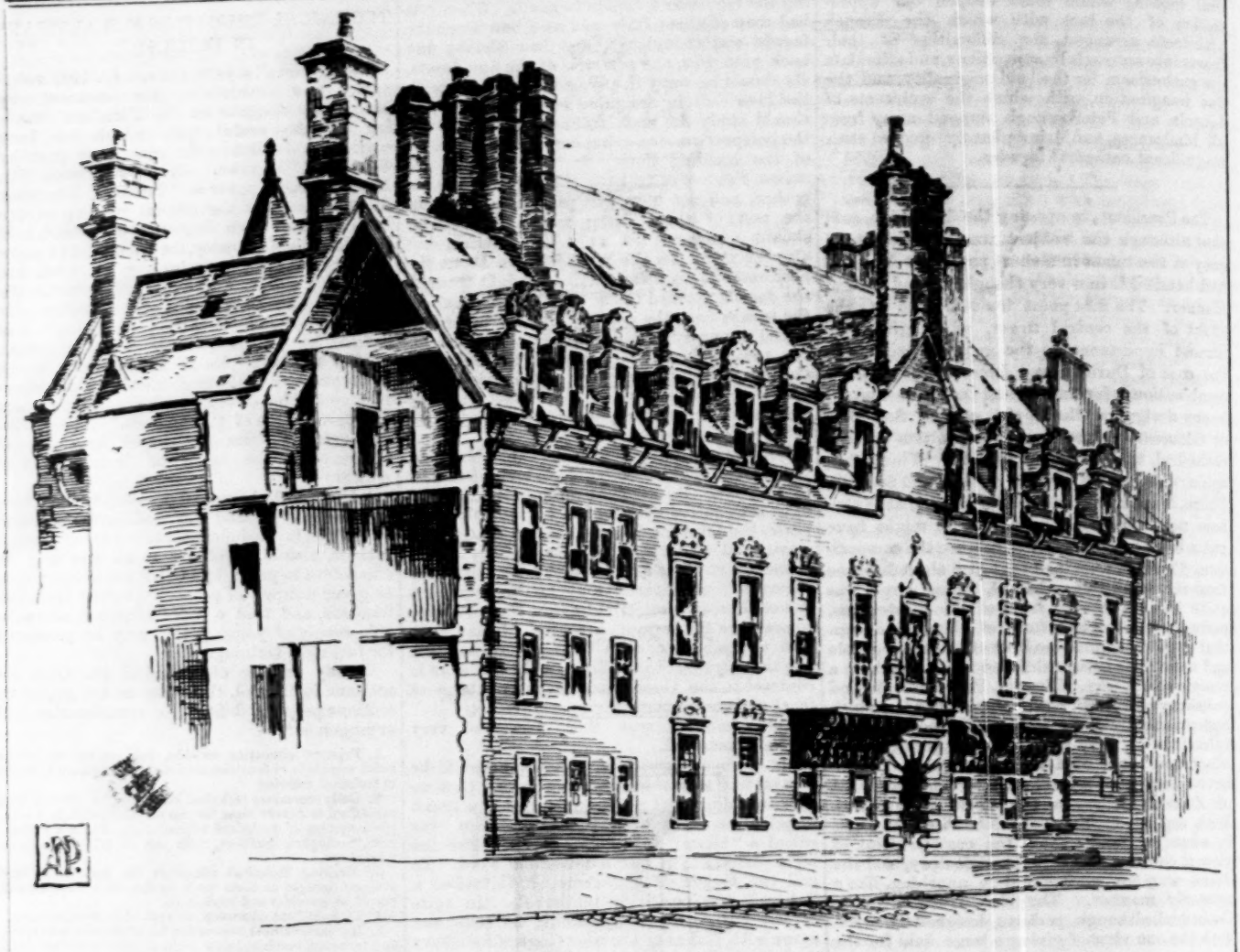
In all these grades proper and ample provision should be made alike for male and female education.

In Ireland the want of technical instruction is greater than in England or Scotland, because we want here to recover lost and to create new industries. It is well also to bear in mind that the classes for whom this special education is so urgently required are not able to pay for it, are not likely to clamour for it, and when it is provided, may need considerable inducements to cause them to accept it at first, and for some time. So that unless the State, the municipalities, or individuals, singly or in groups, will voluntarily urge on and assist the establishment of such institutions, and will maintain them even in the face of much discouragement, we may be sure that our Irish industries will remain at a low ebb.

The primary education of the children of artisans, farmers, and the lower middle classes in Ireland is almost exclusively under the National schools system.

The primary education of children of all classes, apart from questions of social position, which, by the way, are more considered in Ireland than in any other country in the world, might with advantage be the same in degree and in kind for all children up to the age of twelve; here the kind and degree of education must necessarily begin to differ, for some children must soon after be earning their living, while others, whose parents intend them for higher industrial or commercial pursuits, or for professions, will continue their education for many years. For children of artisans up to twelve or thirteen years of age, we may be content with the National schools, provided always that rudimentary drawing, elementary geometry, and the use of ordinary tools be included in the compulsory curriculum of that system of education. If the National Board will revise their class-books, to afford better rudimentary instruction in science, and will furnish their children with instruction as well taught as their reading, writing, spelling, and arithmetic, the children will be placed in the very best possible position, and with the requisite knowledge to enter the technical day schools or night classes.

In recommending the teaching of the use



Old University Buildings, Glasgow.

of tools to young children, let it be quite understood that such teaching is simply intended as useful discipline for the eyes and hands, an exercise for the senses of sight and touch, to quicken the perception of form, size, roughness, staightness, and measurement, and to encourage general handiness; but not to teach any handicraft, not to occupy any of the time required for other studies, and not to have any bearing upon the terms of apprenticeship.

The teaching of the use of ordinary tools to ordinary children at an early age would have a very important and useful effect, especially on the Irish nature; it would tend to break down absurd class distinctions; it would teach that there was nothing derogatory in handiwork; it would tend to abolish the stupid idea that the clerk at his desk is in a higher grade of life than the artisan at his bench; it would show that a steel file was as noble a tool as a steel pen, and even less liable to create mischief in the world; it would most surely have a tendency indirectly to develop tastes which would turn many likely youths to honourable and well-paid manufacturing industries, instead of to the over-crowded, badly-paid, drudgery of clerkship.

In concluding his paper, Mr. Maguire thus recapitulated the requirements of technical school promoters in Ireland:—

1st. That primary education in the national and other schools in Ireland be remodelled and made compulsory.

2nd. That technical schools, as described, be established in every city and town in Ireland, to prepare young artisans for their trades, both in day schools before they engage in actual work, or, as continuation, evening schools during their apprenticeship term.

3rd. That the apprenticeship customs be encouraged and re-established, with clauses in indentures to compel apprentices to attend evening technical schools.

4th. That employers support and encourage technical schools, and employ only such artisans as show the desire for technical improvement by attendance on technical classes.

5th. That the State aids liberally with funds the efforts made to establish and maintain primary, intermediate, and higher technical education, through the length and breadth of the land.

6th. That the artisans and apprentices should themselves appreciate and take advantage of the benefits offered by technical schools.

In olden times, added the lecturer, success in manufactures and commerce was greatly due to local advantages, but now, owing to the progress of engineering, industrial competition has become one of intellect, and the best educated nation, as well as the best educated artisan, will henceforth be the most prosperous. This paper has been written in the hope that it may, in some degree, tend to show the greatness of the need for the technical education of Irish artisans, and may thus far help to supply that need, and secure the resurrection and future success of our lost and languishing industries."

THE PROPOSED CATHEDRAL AT LIVERPOOL.

A meeting of the Cathedral Committee was held at the Walker Art Gallery, on Tuesday, for the purpose of further considering the designs sent in by the architects. The bishop of the diocese occupied the chair, and there were present Sir W. B. Forwood, Mr. Arthur Earle, Mr. W. Bartlett, Rector Stewart, the Rev. John R. Eyre, Mr. Alfred Turner, the Rev. S. Wilkinson, and Canon Warr.

It was moved by Sir W. B. Forwood, seconded by Canon Warr, and resolved:—"That Mr. Ewan Christian be invited to inspect the plans of the competing architects and furnish the committee with his report thereon at the earliest possible moment."—*Liverpool Post.*

Extensions at Woolwich Arsenal.—Several new buildings of a large and costly character are being erected at Woolwich Arsenal. They include a new torpedo factory, which will cover about an acre of ground. The brickwork contract for this building has been taken at 7,000*l.*, and in clearing the ground for it, a large timber-built storehouse has been removed bodily on rollers across a roadway, and on to a vacant piece of land one hundred yards distant. The cartridge factories are likewise being enlarged, and new stores and workshops are being erected for the Royal Gun Factories and the Royal Carriage Department, whilst a second main is being laid down for hydraulic purposes between the Royal Arsenal and Shooter's Hill.

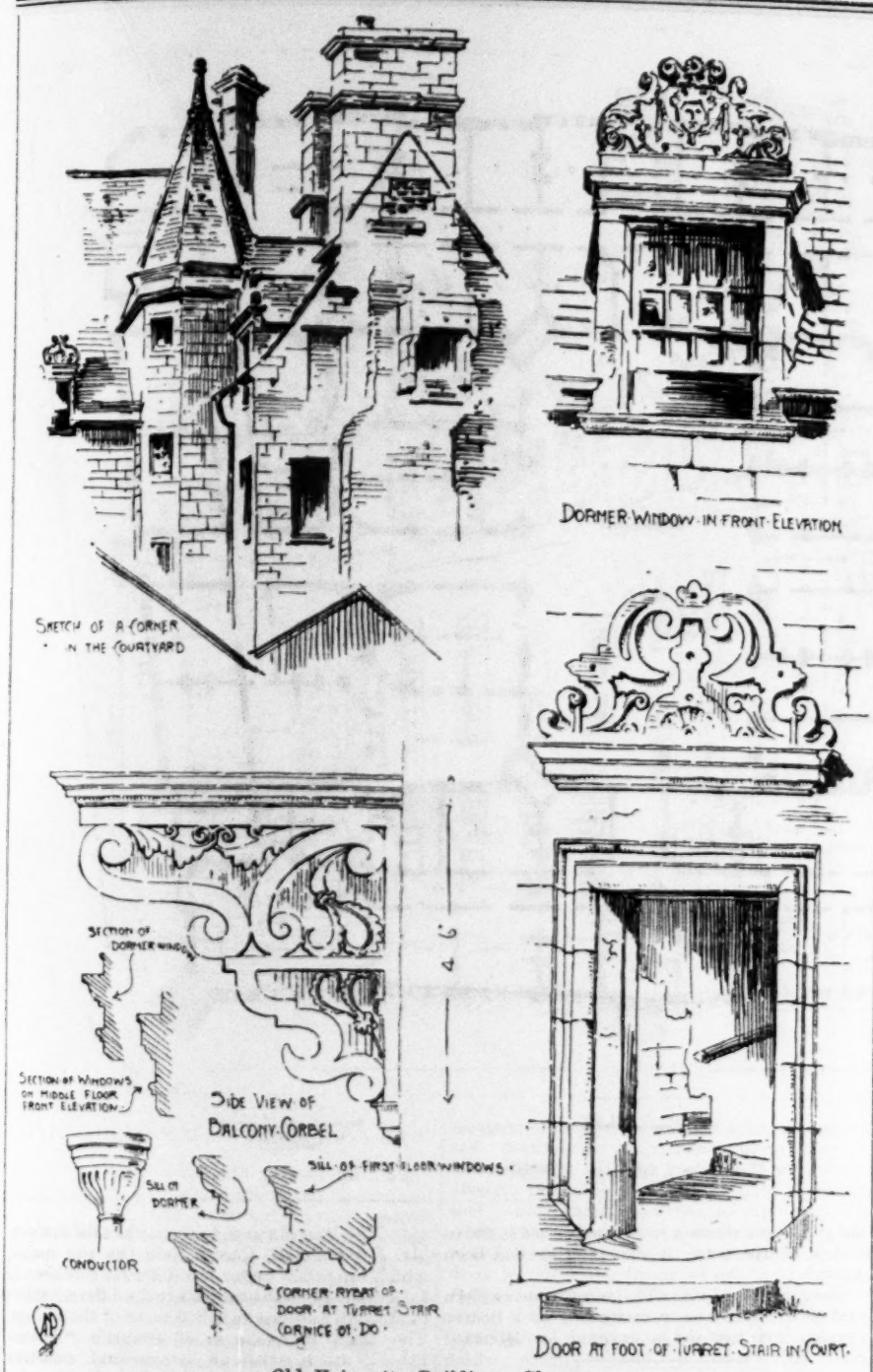
OLD COLLEGE BUILDINGS, GLASGOW.

This interesting old building, in which the business of the more ancient of our two great Scotch Universities was conducted for about two centuries and a quarter, stands in the High-street of Glasgow, and is at present used as a railway station. The *profanum vulgus* throngs its courts and *carmina non prius audita* shrill against its grey walls.

To meet the ever-growing requirements of *Alma Mater*, the University migrated in 1870 to the beautiful pile of buildings erected in the west-end of the city by the late Sir Gilbert Scott, and the old buildings have suffered a partial demolition, which is soon to be completed. It is, however, satisfactory to be able to record that the principal gateway in the façade, with which so many historical associations are connected, and which yet recalls many a student's prank and many a student's triumph to the memory of the present generation, is to be preserved and re-erected as a gate-house to the grounds of the new building.

The old college was commenced in the third *lustrum* of the seventeenth century, and, after many struggles with the adverse times and the solicitation of subscriptions from all classes of the community, was completed about 1660. The original subscription list, which is still preserved, is headed by King Charles I. with a donation of 200*l.*, entered in his own handwriting, dated at Seton in 1633, and a note is added that this sum was paid by the Lord Protector in 1654.

Mr. Billings, in his "Baronial and Ecclesiastical Antiquities of Scotland," in which there are five valuable and interesting sketches of the buildings, says of the general style of the edifice that it is a mixture of the English Elizabethan with the peculiar architecture which Scotland borrowed from France in the seventeenth century. It has the balconies, the tal rectangular chimney stalks, corner to corner, and the variously-decorated window tops of the former; while the narrow rocket-topped towers of the latter, polygonal or circular, are conspicuous in the quadrangle. The massive


SKETCH OF A CORNER IN THE COURTYARD
DORMER WINDOW IN FRONT ELEVATION
SECTION OF DORMER WINDOW
SECTION OF WINDOWS ON MIDDLE FLOOR FRONT ELEVATION
SIDE VIEW OF BALCONY CORBEL
SILL OF FIRST FLOOR WINDOWS
SILL OF DORMER
CONDUCTOR
CORNER RYBAT OF DOOR AT TURRET STAIR
CORNICE OF DO
DOOR AT FOOT OF TURRET STAIR IN COURT

Old University Buildings, Glasgow.

stair, with its stone balustrade, surmounted by curious old carvings of the Scottish lion and unicorn, mentioned by Mr. Billings, has been removed to the new building at Gilmorehill.

The sketches show the principal façade, with its arched gateway and sombre windows, and a doorway and turret top in what was the principal quadrangle. There are also some details of the richly-ornamented window-tops, and of a curious old leaden rhone from the front of the building.

Highgate School.—The roof to the apse of the school chapel, which is dedicated to St. Michael and All Angels, has just been richly decorated. The surface which has been treated is divided by curved ribs from the apex into five compartments, which are each subdivided into three panels. The lower and largest tier of panels is filled with figures in groups of three, representing St. Michael, supported on either side by the other Archangels, with the Virtues, Principalities, and Powers, all being painted in colours on a gold background. The panels above are filled with constellations in raised gold on a blue ground, and above that again plain gold radiating from the apex. The ribs, mouldings, and cornice are picked out with gold and colours. The work has been executed by Messrs. Heaton, Butler, & Bayne, of Garrick-street, under the supervision of Mr. C. Pemberton Leach, architect, of Conduit-street.

BRITISH ARCHÆOLOGICAL ASSOCIATION.

At the meeting of this Association on the 3rd inst., the chair was taken by Mr. Geo. R. Wright, F.S.A. It was announced that the Bishop of Durham had suggested July 26th for the commencement of the congress, to be held in the county of Durham under his presidency, and that the council had agreed to the date named. Visits will be paid to Durham city and cathedral, Raby Castle, Finchale, Dinsdale, and many other places. Mr. Loftus Brock, F.S.A., exhibited a collection of ancient engravings of German and Flemish towns, mostly of sixteenth-century date, showing the system of Mediæval fortification, fortified bridges with tower and barbican, and many interesting details of early arrangement. Among the number was a bird's-eye view of the Abbey of Einsedlen. Etton church, Northants, was described by Mr. J. T. Irvine, and illustrated by some well-executed drawings. Mr. Earle Way reported the recent discovery of a series of brick arches, the basement of a portion of the Duke of Suffolk's palace in the Borough, Southwark, which were revealed during some works of rebuilding on the site. A large number of fragments of pottery were exhibited, but these indicated the earlier occupation of the site by some Roman building, since they were the work of that people. A paper was then read by Mr. Brock on behalf of its author, the Rev. C. Collier, of Andover, on the remarkable excavations now in progress at Winchester Cathedral, under the direction of the dean, and referred to at length in another column of the *Builder* this week. About 5 ft. of earth is being removed from the base of the cathedral walls, and search for the site of the new minster has been rewarded by the discovery of the wall, apparantly of the south side of the church, which stood parallel to the cathedral. The ancient crypt of the latter is also being cleared out. An old record of ancient earthworks at Alfriston and Wolstonbury was then read, prepared by Mr. A. Cope.

ROYAL SCHOOL OF MINES.

Professor Warington Smyth, F.R.S., in continuing his lectures upon mining, in the theatre of the Geological Museum, Jermyn-street, devoted his attention to the various means by which ground of a watery or loose character may be driven through. After commenting upon the ordinary method of *spilling*, he directed attention to the Thames Tunnel as being one of the most instructive pieces of work of the kind, the history of which ought to be studied by the student with every care. Two failures had already taken place in an attempt of a similar kind, one at Gravesend in 1799, and the other at Rotherhithe in 1804. The second one had been carried 923 ft., and to within 150 ft. of the opposite shore, but difficulties of an insuperable character were then met with, and the work was abandoned. Brunel, the engineer of the Thames Tunnel, sank a shaft 50 ft. in diameter 150 ft. from the river on the Rotherhithe side. He effected this by constructing on the surface of the ground a substantial cylinder of brickwork of 50 ft. diameter, the walls of which were 3 ft. in thickness, and 42 ft. in height, and then by raising the earth from the interior was enabled to sink the whole structure to a depth of 65 ft., when a smaller shaft 25 ft. in diameter was put down. By this means he was able to pass through the bed of gravel and sand 26 ft. deep, full of water, of which geologists had advised him to beware, and which, in fact, had rendered the second attempt previously referred to impracticable at the last moment. At a depth of 63 ft. the horizontal excavations for the body of the tunnel was commenced. The whole area of the excavation, which was 38 ft. in breadth, 22 ft. 6 in. in height, and the base in the deepest part of the river 76 ft. below high-water mark, was constantly covered and supported by an iron shield. The shield consisted of twelve great frames, lying close by each other, and which frames were 22 ft. in height and 3 ft. in breadth. They were divided into three stories, thus presenting thirty-six chambers or cells for thirty-six workmen. While the miners cut down and secured the ground in front the bricklayers were simultaneously engaged in carrying forward their work.

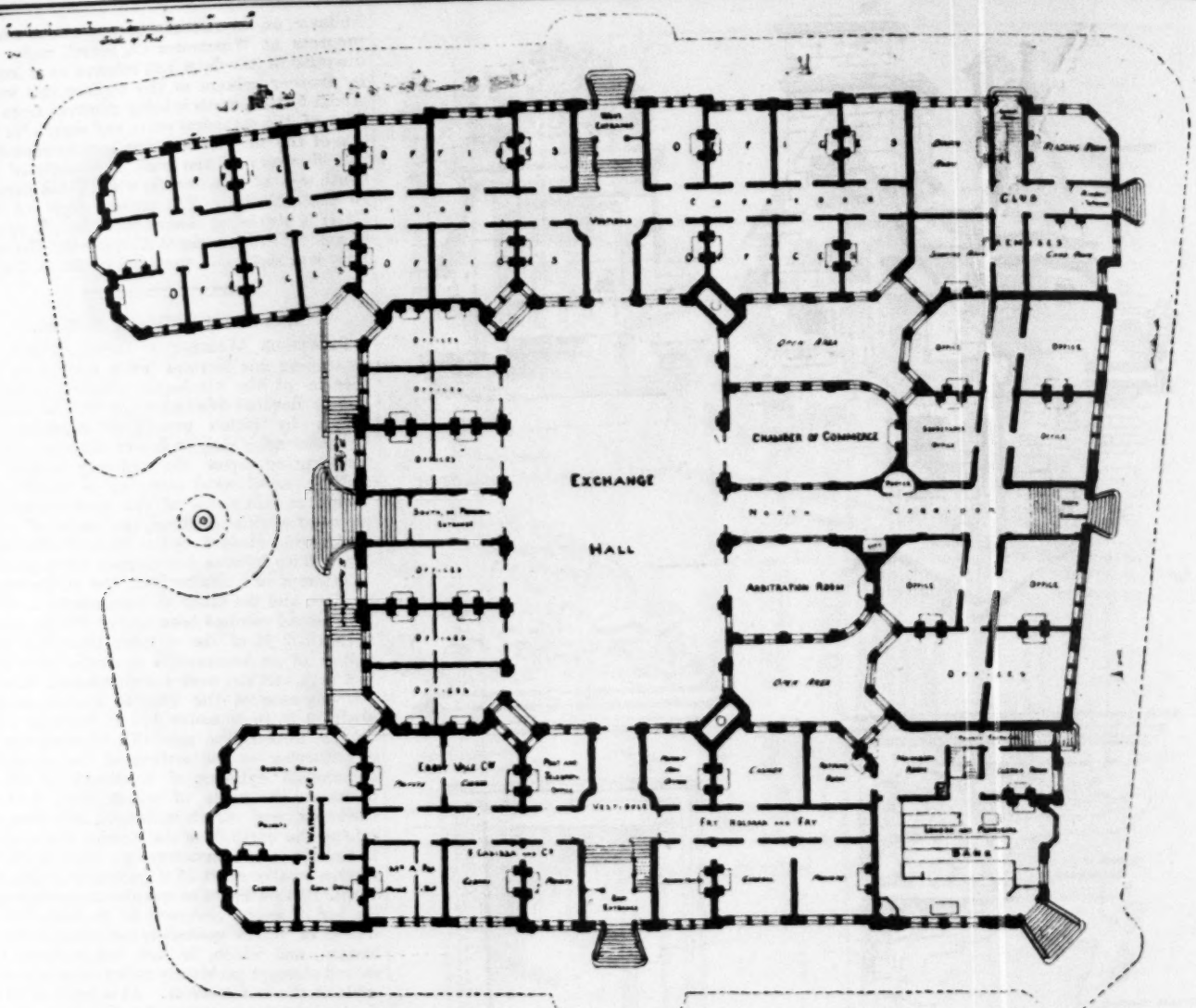
Illustrations.

LIVERPOOL CATHEDRAL DESIGNS.

We give this week a view of the central western porch of Messrs. Bodley & Garner's design, a view in the choir, and the two principal sections. The longitudinal section shows the seating of the great central spire. The view in the choir shows how very closely the architects in this portion of the building have followed the suggestions of Lincoln Cathedral.

We may observe that in one of the exhibited drawings the architects have introduced an alternative leaflet, cutting off the large spire and showing the great lantern only. The effect, though very different in regard to the whole balance of the composition, is perhaps not inferior to that of the spire, and does away with all idea of constructional risk. In a future number we will give the remaining longitudinal elevation in this form, so that our readers can judge of the effect.

We should observe that the lithographs of the longitudinal section and the view in the choir are somewhat deficient in clearness of definition, owing to the fact that they had to be photographed at the Liverpool Exhibition under very disadvantageous light. As the defect is from causes beyond the lithographer's control, we think it better to give the illustrations, merely explaining the cause of their partial defect.



The Exchange Buildings, Cardiff.

THE NEW EXCHANGE, CARDIFF.

THE new Cardiff Exchange, as we briefly stated last week, was opened on the 1st inst. It has been erected by a limited liability company on a site in Mount Stuart-square, from plans prepared by Messrs. Seward & Thomas, architects, Cardiff. We give a view and plan.

At starting, considerable difficulty was anticipated in meeting with proper foundations for so extensive a building, but it was not until actual trial shafts had been sunk by the builder, Mr. Burton, of Cardiff, to whom the contract for the first part had been let at 25,550*l.*, that the true state of affairs in this respect was ascertained. The site was then found to be composed almost entirely of the alluvial mud which prevails in that district. The substratum was here found to be about 30 ft. in thickness, and of the consistency of butter. In certain places, also, the ground had been honeycombed and filled in with slag from the old Cardiff Glass Works, which existed about half a century ago on that portion of the moorlands now occupied by Mount Stuart-square and its surroundings. Few more serious problems could present themselves to everyone concerned than to erect a large building upon such ground as this, and a solution of the difficulty was regarded, not only with anxiety, but interest. After considerable deliberation, the directors agreed to the proposal of the architects to excavate the mud until the gravel was reached. When this had been accomplished it was obvious that, owing to the large number of buildings in close proximity, it would be dangerous to proceed in the customary manner with trenches for foundations, so the plan adopted was that of sinking a series of shafts, but these had necessarily to be very small, owing to the treacherous nature of the surrounding mud. Concrete was then filled in, and upon the piers built thereon were constructed massive arches, on which the whole building has been erected.

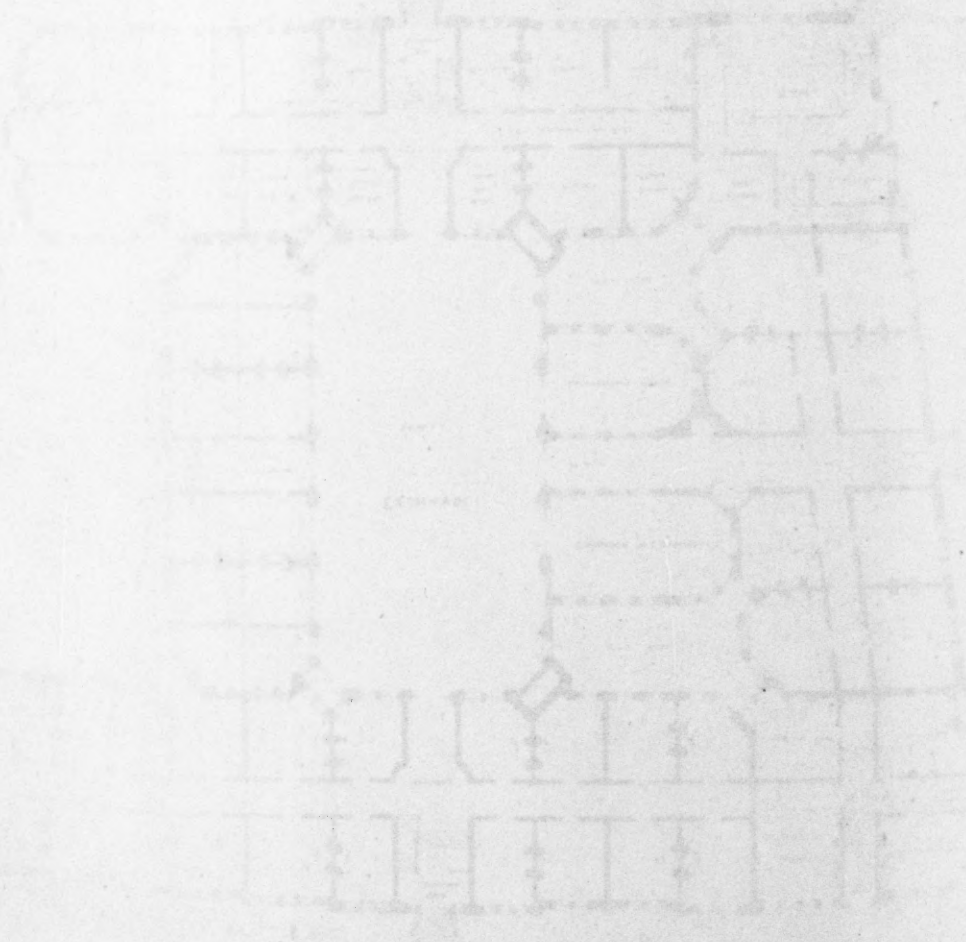
The present block, which covers the eastern part of the quadrangle, is formed by a centre pavilion and two wings covered by Mansard roofs, surmounted by lantern lights, which transmit daylight into the corridors traversing the building. The eastern block contains a large central hall, 100 ft. in length, 50 ft. in breadth, and about 50 ft. in height, which has been opened as the Cardiff Exchange. A broad flight of stairs leads up to the centre of the building, from the vestibule of which corridors lead on the right and left to suites of offices. The Exchange Hall is entirely surrounded by galleries giving access to the offices which flank it. These galleries are constructed on iron cantilevers. The roof is carried on massive semi-circular ribs of iron, the spandrels of which are decorated with volutes and scrolls of iron. An effective design of pilasters and arches covers each end wall of the hall, and the tympana of pediments in the upper part or filled with figure designs in *sgraffito* work. The designs are emblematic of Commerce and Industry. They are the work of Mr. Wormleighton, of Cardiff, as also is the carving throughout the building. The floor is covered with a design arranged in large panels of Maw's styles, with a margin containing prismatic pavement squares, giving light to a corridor in the basement. Small moveable offices, constructed in oak with tinted glass panels, made from the architects' designs by Messrs. Lewis & Lewis, Cardiff, will be placed on each side of the hall.

As stated above, the general contractor was Mr. C. Burton, of Cardiff. The wrought-iron roof-principals were supplied and fixed by Mr. A. D. Dawnay, of London; the heating apparatus is by Messrs. James Allen, Sen., & Son, Glasgow. Messrs. F. Whitfield & Co. supplied the strong-room doors in the bank basement; and Mr. S. Evans, of West Smethwick, executed the lead glazing, to the architects' designs. Mr. J. Woodman, Cardiff, laid the gas mains, which are taken under the different corridors in false ceilings, with branches to the different suites of offices), and has supplied most of the fittings. The main staircase is of Stuart's "Granolithic" stone, with an ornamental cast-iron balustrade, by Macfarlane & Co., who also supplied the railing to the galleries around the Exchange Hall. The handrail of the staircase is in teak, and those to the galleries in pitch-pine, all handsomely moulded to special designs. Messrs. Cordingly supplied the plaster enriched frieze panels in the hall; whilst the ornamental capitals were specially designed and modelled by Mr. Wormleighton.

The false ceilings under corridors above referred to are utilised for the telephone-wires, as also for the zinc pipes by means of which the foul air from the different offices is conducted to a central ventilating extraction-shaft, 70 ft. high, which is heated by an iron flue-pipe from the boiler, assisted by a series of gas-jets, which will be lighted when the heating apparatus is not at work. The whole of the works under contract No. 1 have been executed in about two years to the satisfaction of the architects, Messrs. Seward & Thomas. Mr. F. J. Veall has acted as architects' assistant and clerk of works since the commencement, and Mr. W. Williams was the contractor's foreman.

All the principal offices are occupied, and, since the opening on the first inst. a large amount of business has been transacted daily in the New Exchange, which will doubtless be found a great convenience.

The contract for the southern block, now in course of erection, has been let to Mr. F. S. Lock, of Cardiff, for 5,300. This work has been in progress about two months, and is expected to be finished by October or November. It will comprise an addition to the restaurant premises, rooms suitable for coffee-tavern purposes, and suites of offices.



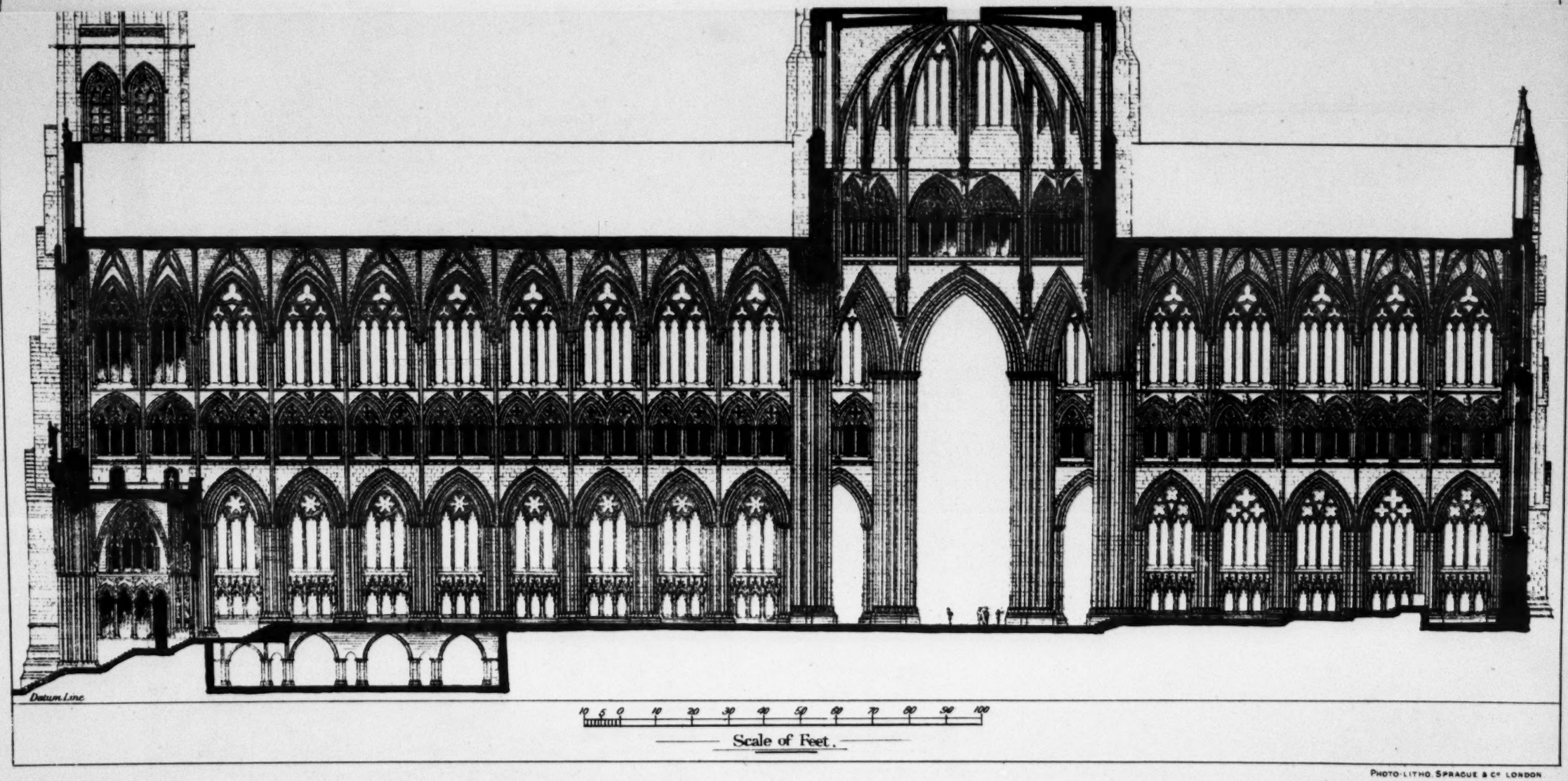


PHOTO-LITHO. SPRAGUE & Co LONDON

LIVERPOOL CATHEDRAL COMPETITION.—Design by Messrs. G. F. Bodley, A.R.A., and T. Garner.

Longitudinal Section looking North.

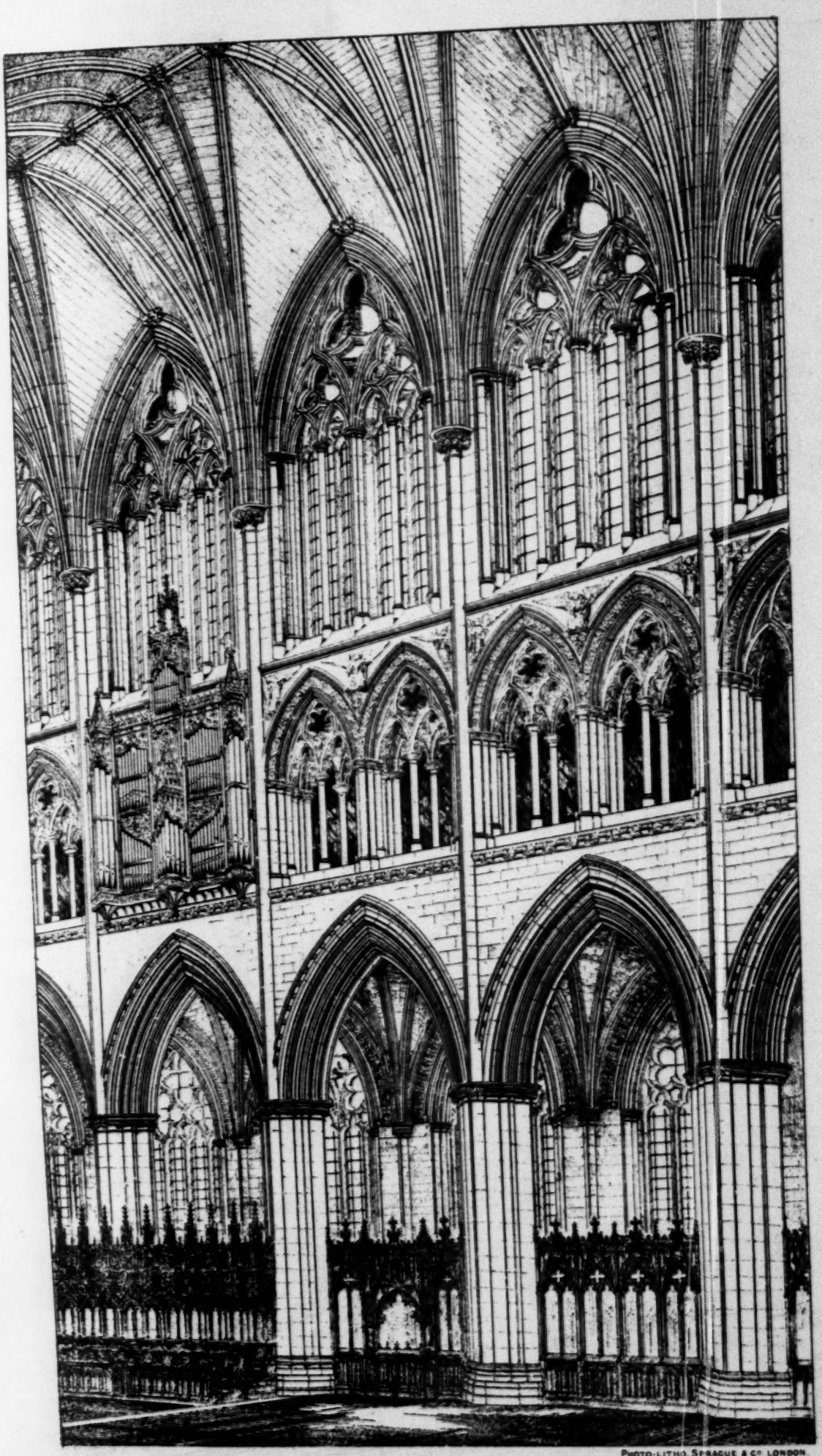
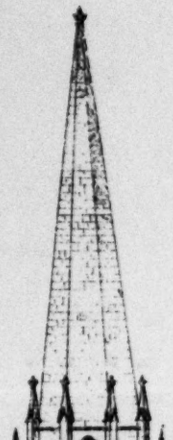


PHOTO-LITHO. SPRAGUE & Co. LONDON.

LIVERPOOL CATHEDRAL COMPETITION.—DESIGN BY MESSRS. G. F. BODLEY, A.R.A., AND T. GARNER.

VIEW IN CHOIR.



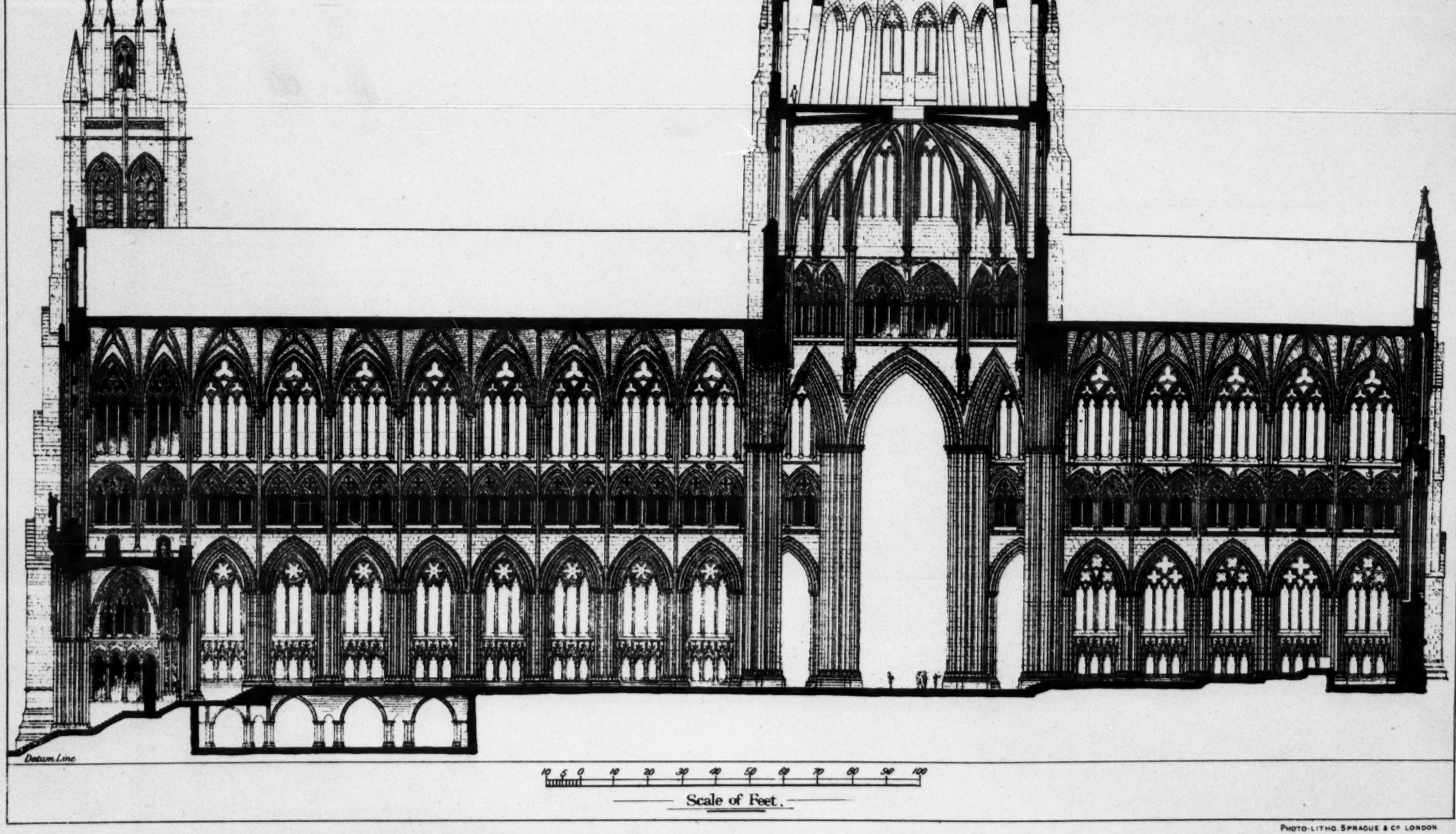
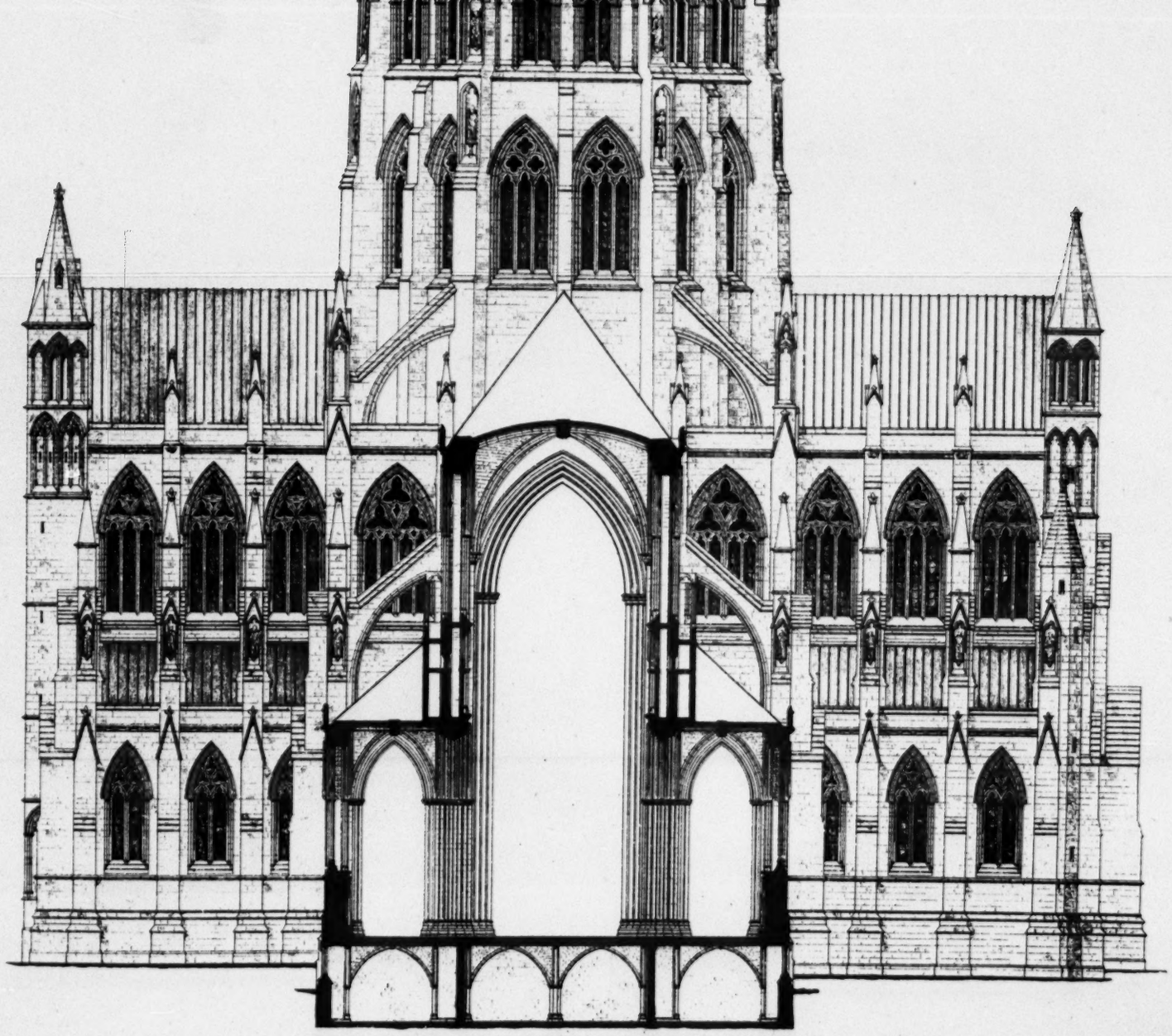


PHOTO-LITHO. SPRAGUE & Co LONDON

LIVERPOOL CATHEDRAL COMPETITION.—DESIGN BY MESSRS. G. F. BODLEY, A.R.A., AND T. GARNER.

LONGITUDINAL SECTION LOOKING NORTH.



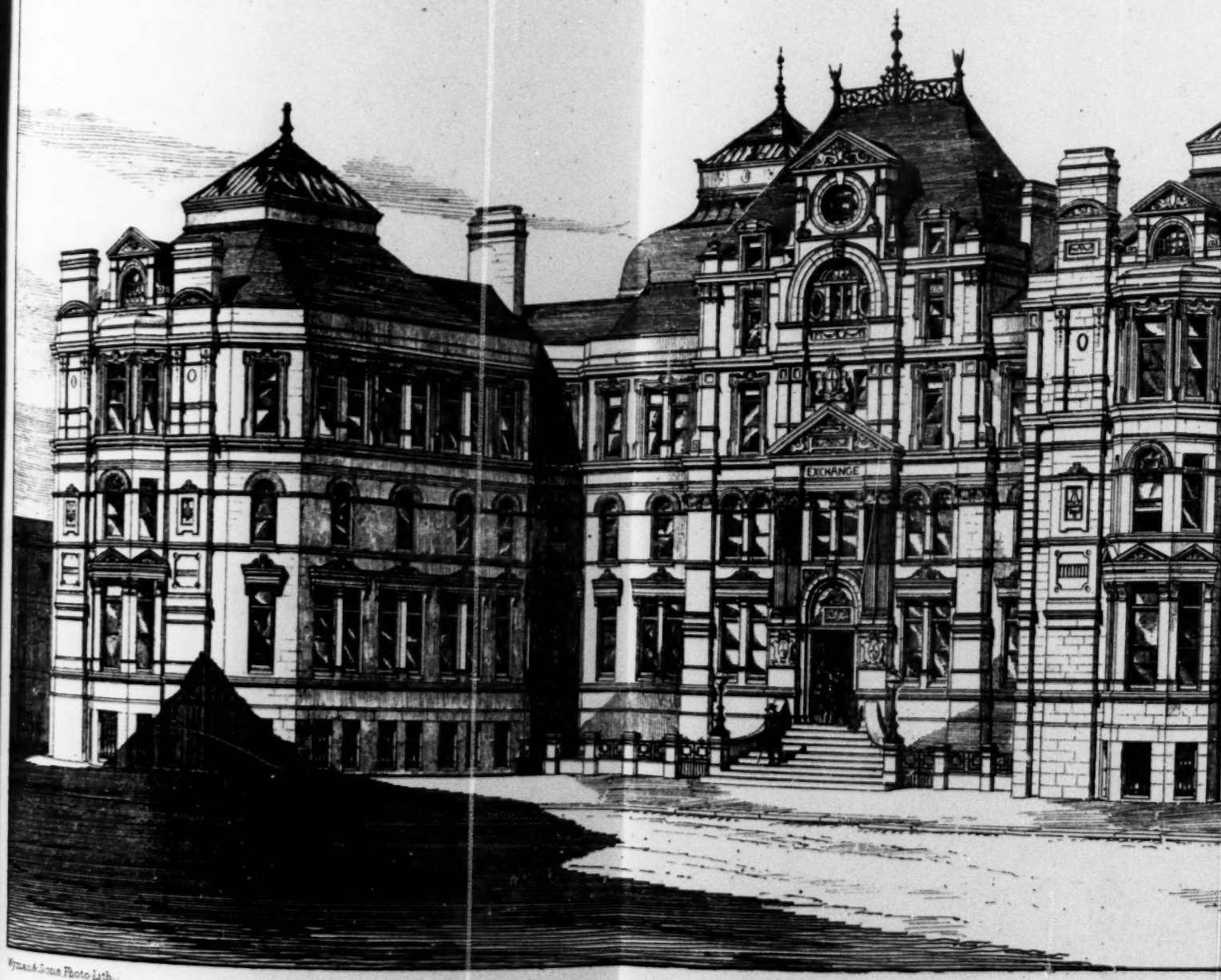
Section through Nave looking East.

C. F. Kell Photo-Lith & Printer.

8 Castle St Holborn London E.C.

LIVERPOOL CATHEDRAL COMPETITION.

DESIGN BY MESSRS. G. F. BODLEY, A.R.A., AND T. GARNER.



Wyman & Sons Photo-Lith.

THE NEW EXCHANGE BUILDINGS, CARDIFF.—Messrs. S

C. Queen St. London. W.C.

ESSRS. SEWARD & THOMAS, ARCHITECTS.

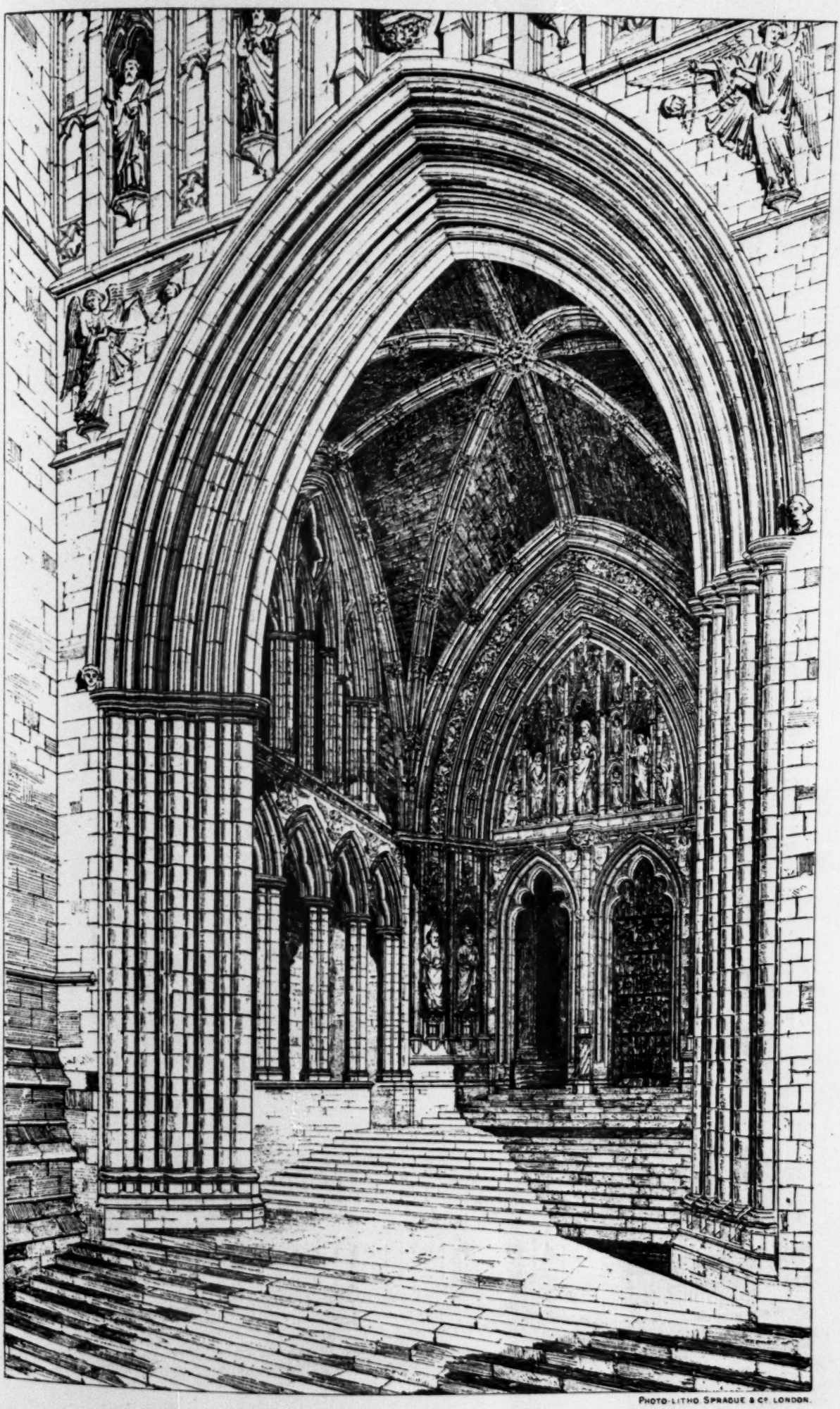


PHOTO-LITHO. SPRAGUE & Co. LONDON.

LIVERPOOL CATHEDRAL COMPETITION.—Design by Messrs. G. F. Bodley, A.R.A., and T. Garner

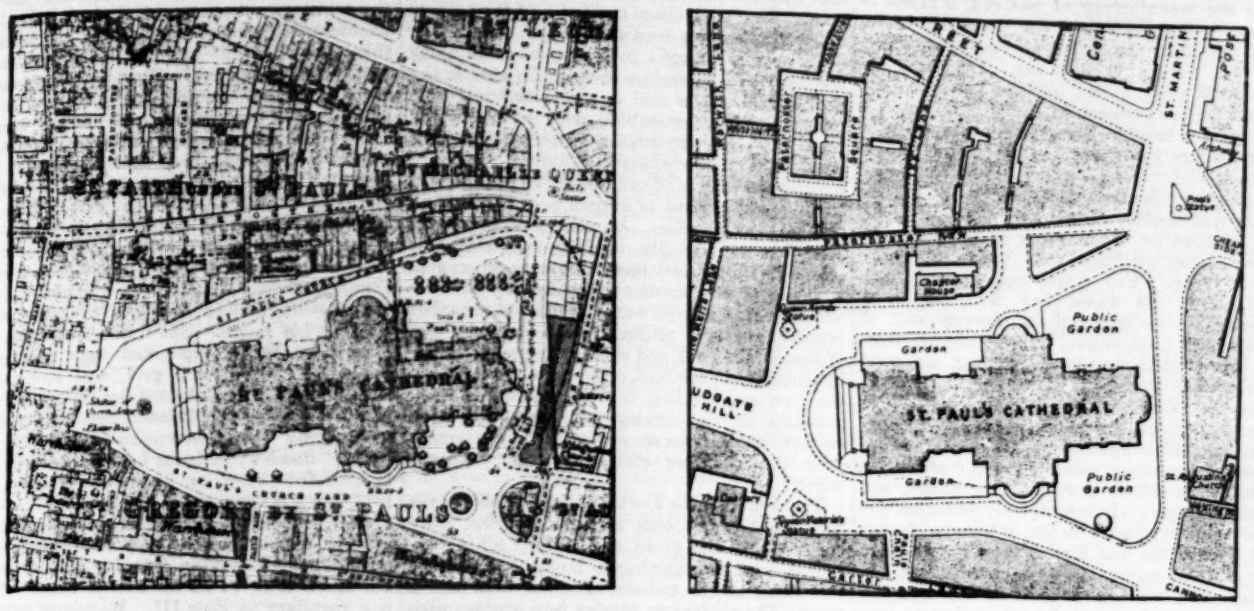
Centre West Portal.

ST. [illegible]

[illegible]

[illegible]

[



As at Present. [*St. Paul's Cathedral Approaches.*] *As Proposed by Mr. de Lisle.*

ST. PAUL'S CATHEDRAL APPROACHES.

THE annexed plans represent the present state of the approaches contiguous to the east end of St. Paul's Cathedral, and the plan proposed for modifying and improving them, in a pamphlet by Mr. Edwin de Lisle,* who, in asking us to call attention to this suggestion for the treatment of the approaches, adds the following remarks:—

"Starting with the idea that ultimately all the buildings round the cathedral should agree with the parallax of Wren's noble temple, which at present is only the case with the Chapter House, it is urged that a line drawn from 42, St. Paul's-churchyard to the Church of St. Augustine and St. Faith is the true line of departure at the east end, with a view ultimately to carry a noble and almost straight thoroughfare from St. Martin's-le-Grand to Queen Victoria-street, 'wide, airy, and direct to the Thames highway.' By rebuilding east of this line, and blocking up the part of Old Change, adjacent to the site of St. Paul's Schools, I calculate that only 2,290 ft. of building ground would be lost at this spot, valued at about 45,800*l*. The semicircular building at the S.E. corner being valued at 70,000*l*., a straight road, of a good width and parallel to the transepts of St. Paul's, might thus be made for an approximate cost of 115,800*l*. This would, of course, prepare the way for widening Old Change right down Lambeth-hill. Such an arrangement would allow of the addition of no less than 11,700 square feet to the garden at the south-east angle of the cathedral. It would entail the loss, possibly, of some 3,000 square feet at the northern angle of the north-east garden; but since the large trees might be made to stand in the causeway, as they do in Piccadilly, and the railing round the garden need not be higher than it is in Leicester-square, the whole square round the cathedral would have the appearance of being a lovely garden, especially if the suggestion of adorning the windows and balconies, with banks of flowers and grasses were carried out. The next most practical feature in this scheme is the widening of Paul's Chain and Godliman-street to the width of Bennett's Hill. As such an improvement as this would decidedly benefit the owners of the property on either side, no compensation would be necessary, it seems just to say, for disturbance,—20,000*l*. ought to cover the whole cost. The Commissioners of Sewers might certainly look upon this merely as the removal of a scandalous nuisance, and by one stroke give a fine view of the south-east campanile, and at least one good approach to St. Paul's from Queen Victoria-street."

The Nineteenth Century Art Society.—Saturday, the 13th inst., has been appointed for the private view of the Spring Exhibition of the Nineteenth Century Art Society, at the Conduit-street Galleries, and the Exhibition will open to the public on Monday, the 15th inst.

* The Majesty of London. By Edwin de Lisle. London: E. Stanford. 1885.

THE PRINCIPLES OF DOMESTIC FIREPLACE CONSTRUCTION.

THIS was the subject of the Friday evening discourse at the Royal Institution on the 5th inst., the lecturer being Mr. T. Pridgin Teale, M.A., F.R.C.S., who is already known to most of our readers as an investigator in this important field of applied science, and as a writer on sanitary subjects.

Mr. Pridgin Teale, at the outset, referred to the appropriateness of the use of the lecture-theatre of the Royal Institution for a lecture on this subject, seeing that Count Rumford, the founder of the Institution, devoted a great deal of attention to the study of the subject, which was particularly referred to in the prospectus of the Institution as "a very important part of the useful information to be conveyed in the public lectures of the Royal Institution." Correct principles, said the lecturer, have been habitually, and, until the last few years, almost universally, violated, and the rules so ably worked out, so earnestly and forcibly advocated by Rumford, have lain dormant, lingering here and there, chiefly in old-fashioned houses, and almost forgotten. Three evils result from the prevalence of bad principles in construction:—1. Waste of fuel and loss of heat. 2. Excessive production of soot and smoke. 3. Large addition to ashpit refuse by cinders, which are really unburned, and therefore wasted, fuel. These are matters of national concern, and it has been the main object of my labours on this question during the last four years to endeavour to convince the public that it is the interest no less than the duty of every householder, to burn his fuel on correct principles, and to do his part towards the diminution of these evils. Heat is wasted in three ways,—either by combustion under the impulse of strong draught, which means rapid escape of heat up the chimney; or by imperfect combustion of the gases which are generated during the burning of the coals; or by escape of heat through the iron sides and back into the space between the range and the brickwork and its top into the chimney. The greatest offenders are the ordinary register grates. Iron all over, back, and sides, and roof, they are usually set in a chamber open above to the chimney, and imperfectly filled in, or not filled in at all, with brickwork. The heat escapes through the iron to this chamber, and thence is lost. Another fault is that the "register opening," in other words the "throat of the chimney," being immediately above the coal, submits the burning fuel to the full concentrated force of the current to the chimney, converting the fire into a miniature blast-furnace.

The second result of faulty construction in fireplaces is "Undue production of smoke and soot." Smoke and soot imply imperfect combustion, and to this two defects in a fire mainly contribute,—one, too rapid a draught through the fire which hurries away and chills below burning point the gas rising from the heated fuel. The other defect is too cold a fire, *i.e.*, too small a body of heat in and around the fuel, so that the temperature of the gases is not raised to a point at which they will burn.

A few years ago the prevalence of unusually dense fogs roused the metropolitan public to a sense of this great evil. The Smoke Abatement Society was formed, and under its auspices exhibitions of smoke-consuming apparatus and improved fireplaces were held in London and Manchester. Beyond the fact that certain grates were pronounced to be good in point of economy, and moderate in the production of smoke, and that the public has been led to take an interest in and inquire into the relative value and economy of various patent fireplaces, there has been but little advance in the education of the public in the principles which lie at the root of the whole question.

A third result of bad construction is the "production of cinders." With good coal, cinders are inexcusable. They are unconsumed carbon,—coke,—and imply a faulty fireplace. If thrown into the ashpit, as is the case in 99 times out of 100, they are shameful waste, and more than waste, for they entail a great cost for their removal. The town of Leeds pays about 14,000*l*. a year for the scavenging of the streets and the emptying of ashpits. Nearly every house in Leeds supplies in the way of cinders at least twice as much ashpit refuse as it might do, were the fireplaces properly constructed. The ashpit refuse of Leeds is burned in a "destructor," and the cinders in the refuse provide not only heat enough for its reduction to a mineral residue, but spare heat for driving two 60-horse-power engines, and for consuming a reasonable amount of pigs, &c., killed by or on account of disease.

These three great evils, evils affecting not only individuals, but the community, waste of fuel and heat, production of soot, production of cinders, are a direct result of the violation of the correct principles in fireplace construction.

Let us next inquire what are the principles which promote good combustion in an open fireplace,—*i.e.*, what are the conditions which are essential to enable fuel to give out to a room "good money's worth in heat." That such a result may be obtained, fuel must burn *well*, but *not rapidly*. Two things in combination are essential to the combustion of fuel,—a supply of oxygen, and a high temperature,—*i.e.*, plenty of heat around the fuel. If fuel be burned with a hot jacket around it, a very moderate amount of oxygen will sustain combustion, and if the supply of oxygen be moderate, combustion is slow. Burn coal with a chilling jacket around it, a rapid conductor like iron, and it needs a fierce draught of oxygen to sustain combustion, which means rapid escape of actual heat, and also of potential heat in unburned gases and smoke, up the chimney. This is the key to the whole position; this is the touchstone by which to test the principles of fireplace construction.

Few people probably realise the exact conditions of combustion, which may be well illustrated from the process of manufacture of coal gas.

In the manufacture of gas, coal is raised to a high temperature, and the gases are driven off by roasting the coal in an oven from which air, *i.e.*, oxygen, is shut out. The gases are conducted away, cooled, purified, and stored for future use in a gasometer; the combined carbon and mineral residue, being non-volatile, is cooled down before being exposed to the air, and is sold as coke. Here we have a striking proof that high temperature in fuel does not of itself imply combustion. If air were admitted to the red hot coke, or to the gases as they escape in their heated condition from the furnace, they would burn. But when coke has become cold, and the gases are cold, as in a gasometer, no amount of oxygen will of itself start combustion. The deduction from all this is, that complete oxydation, *i.e.*, good combustion, is possible only when the fuel and gases are at a high temperature, and that high temperature of fuel does not produce combustion until oxygen is introduced; therefore we can have a high temperature of fuel without rapid combustion, provided we control and limit the supply of oxygen. My attention was first directed to the question of waste of fuel at the time of the coal famine some twelve years ago. I read in the *Times*, and acted upon the suggestion, made, I believe, by the late Mr. Mechi, to economise coal by inserting an iron plate on the grid under the fuel so as to cut off all draught through the fire. This undoubtedly induced slow combustion, and economised fuel, but the fire was dull, cold, and ineffective. The plan was abandoned. It taught me, however, the fact that combustion could be controlled by cutting off the underdraught, but I did not then see why combustion was spoiled. The reason was that the under-surface of the fire was chilled, and the fuel lost its incandescence owing to the rapid loss of heat through the iron towards the open hearth chamber. To some persons even now "slow-combustion stoves" are an abomination, and are supposed to be synonymous with bad combustion. The next stage in my fireplace education was the adoption of the Abbotsford grate. I thereby learned that the reason why an Abbotsford grate was an advance upon the iron plate lay in the fact that the solid firebrick bottom stored up heat and enabled the fuel to burn more brightly resting upon a hot surface,—not upon a cooling iron plate. But Abbotsford grates, and the other class of grates with solid firebrick bottoms, the "parson's" grates, have disadvantages. They are apt to become dull and untidy towards the end of the day, and do net burn satisfactorily with inferior coal. There is a better thing than a solid firebrick bottom, and that is the chamber under the fire closed in front by an "economiser." Some five years ago I made, somewhat accidentally, the discovery that the burning of coal in an ordinary fireplace could be controlled and retarded by the adoption of a very simple and inexpensive contrivance, applicable to nearly every existing grate, and that this result could be attained without impairment of, and often with increase of, the heating power of the fire. This contrivance, which I have named an "Economiser," was simply a shield of iron, standing on the hearth, and rising as high as the level of the grid at the bottom of the grate, converting the hearth space under the fire into a chamber closed by a movable door. The effect was twofold. The stream of air, which usually rushes through the bottom of the fire, and causes for a short time rapid combustion at a white heat, was thereby cut off, and the air under the fire was kept stagnant, the heated coal being dependent for its combustion on the air passing over the front and the upper surface. The second point was that this boxing up rendered the chamber hotter, and this increased temperature beneath the fire-grate, *i.e.*, under the fuel, added so materially to the temperature of the whole, even of the cinders coming into contact with the iron grid, that the very moderate supply of oxygen reaching the front and upper surface of the fuel was sufficient to maintain every portion in a state of incandescence. Moreover, I observed that combustion was going on at an orange, not at a white, heat. Let us contrast a white with the orange heat. A white heat in a fire means rapid combustion, owing to the strong current of air, oxygen, which passes under the grate, through the centre of the fire, and up the chimney. As soon as the heart of the fire has been rapidly burned away at a white heat, the fuel cools; the iron grid cools also; and the cinders in contact with the grid are chilled below combustion point. They then cease to burn, and the bottom of the fire becomes dead and choked. The poker must now be brought into play to clear away the dead cinders, and to re-open the slits in the choked grid. New coal is added to the feeble remnant of burning embers, with no reserve of heat in the iron surroundings; and in time, and perhaps very slowly, the fire revives, and rapid combustion sets in afresh under the influence of the renewed current of oxygen passing through the heart of the fire. An orange heat means that the coke, *i.e.*, the incandescent cinder, is burning with a slowly applied stream of oxygen, a degree of combustion which is only possible when the coal is kept warm by the hot chamber beneath, and by a reasonable limitation of loss of heat at the back and sides by firebrick, either in contact with the fuel, or, at least, close behind the iron surrounding it. This effect is seen, partially, in the grates with solid firebrick bottom, but far more perfectly in the grates with the chamber closed by the "Economiser."

This hot chamber has the following effects:—The incandescent coal remains red hot from end to end of the grate until nearly all is consumed, thus maintaining a larger body of the fuel in a state to radiate effective heat into a room. The cinders on coming into contact with the iron grid remain red hot, and so continue to burn away until they fall through the grid as a fine powder. This allows the fire to burn clearly all day long almost without poking. When the fire is low, and new coal is added, the reserve of heat in the hot chamber is such that the addition of cold fresh fuel does not temporarily quench the embers, and the fire is very quickly in a blaze after being mended.

Having made the discovery by the observation of a grate supplied to me with an "Economiser," the value of which, I suspect, was hardly appreciated by the makers, I applied "Economisers" one by one to all my grates, kitchen included. The result surpassed my expectations. There was a saving of at least a fourth of my coal. The experience of many friends, who at my advice adopted the system, confirmed my own results. It was, therefore, clear to me that I was bound to make widely known a discovery which was fraught with such benefit to myself, and was likely to prove a great boon to the public. My chief aim hitherto has been to persuade the public to apply the "Economiser" to existing fireplaces. After steady exertions for four years, some impression has been made on the inertia of the public, and extensive trials of the "Economiser" are taking place in many parts of the country. To-day, however, my aims are more complete. It is my wish to advocate not one principle alone, although that is the cardinal one, but to urge all the best principles which enter into the construction of a really effective fireplace, and to induce those whom it may concern to replace bad by an entirely new construction, right in every point. The rules of construction which I shall lay down have been arrived at entirely by my own observation of what appeared to be the best points in various fireplaces. It was, therefore, no less a satisfaction to me than a surprise to discover, on reading Rumford's work in preparation for this lecture, that nothing which I have to advocate is new, but that every principle, and the "Economiser" is hardly an exception, was advocated no less enthusiastically by him at the very commencement of this century.

Rule I.—"As little iron as possible."—The only parts of a fireplace that are necessarily made of iron are the grid on which the coal rests, and the bars in front. The "Economiser," though usually made of iron, from convenience in construction, might be of earthenware, and so would be more perfectly in harmony with this rule.

Rule II.—"The back and sides of the fireplace should be of brick, or firebrick." Brick retains, stores, and accumulates heat, and radiates it back into the room, and keeps the fuel hot. Iron lets heat slip through it up the chimney, gives very little back to the room, and chills the fuel.

Rule III.—"The firebrick back should lean over the fire, not lean away from it," as has been the favourite construction throughout the kingdom. The lean-over not only increases the power of absorbing heat from rising flame,—otherwise lost up the chimney,—but the increased temperature accumulated in the fire-back raises the temperature of gases to combustion point, which would otherwise pass up the chimney unconsumed, and thus be lost. Rumford discovered accidentally the value of this "lean over," and at once realised its immense importance. He does not, however, seem to have carried out his intention of working out for general adoption this form of back. Of recent years "lean over" backs have been re-invented and sparingly used. The "Milner" back, invented by a Lincolnshire clergyman, and adopted by Barton & Co., is excellent. It burns fuel well and gives out a great heat. But it is extravagant in consumption unless controlled by the "Economiser." Captain Douglas Galton saw the virtue of the "lean over," and adopted it in the grate which goes by his name. The "Bee-hive" back was the same in principle and very good, and, having a very small grid, was economical. The "Rifle" back, adopted by Nelson & Sons, of Leeds, gives an admirable fire, little short of perfection; but observation shows that the "tall" flame extends far beyond the bend, and is, therefore, soon lost as a heating factor, the heat being wasted in the chimney.

Rule IV.—"The bottom of the fire, or grating, should be deep from before backwards, probably not less than 9 in. for a small room, nor more than 11 in. for a large room." This is a corollary to Rule III. We cannot possibly have the back of the fireplace overhanging the fire when there is a shallow grid. If for no other reason than the demands of the "lean over," depth of fire-space is essential. But there is gain, thereby, in another direction. It affords plenty of room for the burning fuel to lie down close to the grid, and away from swift air currents, and prevents the tendency of the fire to burn hollow.

Rule V.—"The sides or 'covings' of the fireplace should be inclined to one another as the sides of an equilateral triangle." The working out of this rule has cost me much thought and experiment. It was worked out more or less empirically with a view to attain certain objects, and, having attained them, I discovered that I bad unwittingly selected the sides of an equilateral triangle. It is of some importance, and may be of interest, to tell how the question arose. In my earlier fireplaces the sides or "covings" were parallel to each other, and had the defect that they radiated most of their heat from one to the other, not into the room, with the probable result that much of such heat would eventually escape up the chimney. It was clear then that the sides must be set at an angle with the back, so as to face towards the room. But at what angle? My first experiments were determined by the shape of the corner bricks which were in the market. These determined the inclination of the sides to be such that, if prolonged, they would meet at a right angle. This is the angle laid down by Rumford as the angle of selection, but as the largest angle admissible in a good fireplace. This angle, however, brought me into difficulties with my "lean over" back. The openness of the angle made the back, as it ascended, spread out so rapidly that what was gained in width was lost in height. Moreover, my critics objected to its appearance as ugly. What then should determine the inclination of the sides? The point was thus determined. Seeing that a heated brick throws off the greatest amount of radiant heat at a right angle with its surface, the "covings" should be at such an inclination to each other that the perpendicular line from the inner margin of one "coving" should just miss the outer margin of the opposite "coving." Where the "covings," as in my earlier attempts and in Count Rumford's fireplaces, are at a right angle to each other, this perpendicular line misses the opposite margin by several inches. It was clear, therefore, that the inclination might be made more acute. Guided by this idea, and having determined the principle on which the shape of the grate should depend, an inclination was arrived at which turned out to be an angle of 60°, *i.e.*, the inclination of the sides of an equilateral triangle.

Rule VII.—"The 'lean-over' at the back should be at an angle of 70°." Commencing at the level of the top of the front bars, it should extend almost to the throat of the chimney, which, as a rule, will be about 28 in. from the hearth, or 16 in. from the top of the fire, and should extend so far forwards that the angle where it recedes towards the chimney should be vertically over the insertion of the cheeks of the fire-grate. This will be from 3½ in. to 4½ in.

from the front of the fireplace, according to the size of the grate.

Rule VIII.—"The shape of the grate should be based upon a square described within an equilateral triangle, and the size to vary in constant proportion to the side of the square." For a moderate room, 8 in. determines a very useful size; for larger rooms, 9 in., 10 in., or even 11 in., may be necessary. An area of grating of 100 in. in the square of the corners would give a grate fireplace large enough for a room 20 ft. by 25 ft. This rule secures sufficient depth from front to back, and a constant proportion between depth and width, whatever be the size of grate. Whenever a grate proves too large for a room, and in summer, when a smaller fire is needed, the size should be reduced in width by fire-bricks, the full depth being retained.

Rule IX.—"The slits in the grating, or grid, should be narrow, perhaps ¼ in. for a sitting-room grate and good coal, ⅜ in. for a kitchen grate and bad coal." When the slits are larger, small cinders fall through, and are wasted.

Rule X.—"The front bars should be vertical, that ashes may not lodge, and look untidy; narrow, perhaps ¼ in. in thickness, so as not to obstruct heat; and close together, perhaps 1 in. apart, so as to prevent coal and cinder from falling on the hearth."

Rule XI.—"There should be a rim 1 in. or 1½ in. in depth round the lower insertion of the vertical bars." The object of this is to conceal the ash at the bottom of the fire, and to enable the front cinders to burn away completely by protecting them from the cold air. This rim contributes greatly to tidiness, and, as a rule, will prevent the need of any sweeping up of the hearth during the day.

Rule XII.—"The chamber under the fire should be closed by a shield or 'Economiser.'" This has been already spoken of, and described as the central principle which enhances greatly the value of all the rest.

Rule XIII.—"Whenever a fireplace is constructed on these principles, it must be borne in mind that a greater body of heat is accumulated about the hearth than in ordinary fireplaces. If there be the least doubt whether wooden beams may possibly run under the hearthstone, then an ash-pan should be added, with a double bottom, the space between the two plates being filled with artificial asbestos, 'slagwool,' 1½ in. in thickness."

Rule XIV.—"A fireplace on this construction must not be put up in a party-wall where there is no projecting chimney-breast, lest the heated back should endanger woodwork in a room at the other side."

TIMBER MEASUREMENT.

SIR,—As you surmise, we have got into a Comedy of Errors, and it will take a little space to put matters straight.

1. Mr. Wardale asks (p. 64), "Why do the sliding-rule and the tables used by timber merchants make it [his oak butt] to be 75 ft.?"

Neither of them does anything of the kind. The original inventor of the principle of the sliding-rule (Lord Napier, the discoverer of logarithms 300 years ago) says virtually, "Give me the *correct* side of a piece of equal-sided stone or atmospheric air, or any other substance, and its length, and I will, by my rule, enable you to arrive at its cubic contents without the trouble of multiplication."

2. I say (p. 143), "He [Hoppus] found a practical custom in use throughout the land, and framed his tables in accordance therewith."

It is not probable that he did so. The tables are merely the sliding-rule reduced to print (for counting-house convenience, no doubt), which sliding-rule was of old only intended for angular substances; but Hoppus, being Surveyor to the London Assurance Company, was necessarily acquainted with and accustomed to the practical, though ignorant, method of measuring round timber by string in use throughout all the country districts of his experience. He took the existing method of obtaining the "side" as he found it, and simply said, "You will get the same result more readily from my tables than from the sliding-rule or multiplication."

What was the poor man to do (even if he knew of the error, which I doubt)? Was he to take his staff and scrip, and tramp through the length and breadth of the land,—a sylvan Peter the Hermit, preaching a crusade in favour of a correct measurement, which he never could have made intelligible, or reduced to possible practice? All Hoppus's remarks show him to have been a rule-of-thumb man, and incapable of detecting spontaneously the fallacy which his tables helped to make easy.

Nesbit, in his "Practical Mensuration" (Longmans), says, "Multiply the square of one-fourth of the circumference or quarter girt by the length, and the product will be the content, *according to the common practice*" (*sic* italics).

He makes no further remark, but gives Rule 2:—"Multiply the square of one-fifth of the girt by twice the length, and the product will be the solidity *nearly*" (*sic* italics).

There is 21 per cent. difference between the two measurements, which Nesbit must have known to be common knowledge amongst all whom it concerned, and therefore he calls no especial attention to the anomaly. The contents can be obtained from the tables by his first incorrect rule; but where is your "side" for the second, correct?

It would take more space than would be justifiable to show why an alteration from the one-fourth girt measurement is barely possible; and I do not see any benefit to arise from such alteration, could it be made general. Nobody buys timber trees in the rough who does not know what he can make of them in conversion, measure how you will; and that regulates the price per foot cube.

Now take Mr. Wardale's own case. An unhappy destiny has saddled him with a large oak butt. I assume that he wants to dispose of it; but it is not a thing to be offered generally, or to be sent to the nearest market like a sack of potatoes; he must, therefore, apply to a timber merchant to buy it.

If the timber merchant offers him 2s. 6d. a foot for it in the ordinary way, without any express stipulation on the part of the vendor, and the latter accepts, the merchant will take the measure by the one-fourth girt method, and custom will bear him out in it. If the vendor stipulates for the strict geometrical rules, the merchant will give him only 2s.

If hewing up and calliper measure are insisted on, our friend will get only 1s. 6d. The parties may, therefore, toss up for the measure and make their minds easy.

GODALMING.

[Finis coronat Hoppus.]

*** We will act on the hint of "Godalming's" audacious pun, and consider the correspondence closed.

"PLUMBERS AND PARLIAMENT."

SIR,—In order to make my meaning perfectly clear to the conveniently obtuse intelligence of "F. M.," allow me to inform him that I consider it is "dabbling in a noisy and ostentatious manner in matters which are being dealt with by others" when "C. A. M. B." dictates to the Plumbers' Company the course they should take instead of that which they are taking for the benefit of their trade,* and when "F. M." has recourse to the press to obtain information which, if he is a member of the Association, as I presume he is, he could have obtained from the Secretary,—and can still obtain if he be so inclined,—respecting the work of the Association, which is altogether at variance with, and contradictory to, the assertion made by him in your last issue.

He may have some crude notions floating in his brain of schemes he thinks would benefit the trade. Why does he not submit them to the test of discussion? Is he nervous as to the result of their being found impracticable; or are they of such a character that the self-interests of builders would be touched? If the latter, he appears to know full well the reception they would meet with. At the present time a great effort is being made to obtain redress for one of our members. This entails some amount of sacrifice, and it is amusing, but at the same time regrettable, to hear the excuses which are put forward by some of the members in order to wriggle out of their share of moral responsibility.

Having had the honour of occupying the position of President for three years, which is one year longer than the recognised time, I may fairly claim to know something of the advantages which have accrued to the trade by the action of the Association during that time, and of which I would gladly furnish you with a list were it not contrary to the rules of the Association to do so. They are, however, of a character such as a President may well be proud of as having occurred during his occupancy of the office. An example of what we are doing appears in the letter of your correspondent, "H. S.," p. 252.

I hope my successor, when appointed, will be able to furnish a better record; but, if it be as good, the trade will have much reason for satisfaction.

I think that I shall not be transgressing the rules of the Association by stating that a not inconsiderable benefit has been secured by the manner in which the matters of difference which have from time to time cropped up between masters and men have been met. Had we desired popularity, such matters could easily have been fanned into a flame; but we preferred peace, and the consequence is that more amicable relations exist now than have been the case for years.

The Association is still without any overture from the Plumbers' Company as to co-operation; therefore, as we do not wish to force their hand, the Association or Builders' Institute will have to take into consideration, as well as they, the question of certifying plumbers as competent, being careful, however, not to put a stumbling-block in the way of a most desirable object.

F. J. DOVE,
President of the Central Association of Master Builders.

SIR,—From long experience of the inconveniences arising from the working hours of plumbers being diverse from those of the other trades engaged in building operations, I quite agree with your correspondent "F. M." that this matter should be dealt with, and I cannot but think that the Central Association of Master Builders exhibits a want of generalship in not taking up this question, now that so many matters affecting plumbers are under discussion.

It would, I feel certain, be a great benefit to the employers and all those in charge of building works, could the hours of labour be made uniform for all trades, and they would owe you a debt of gratitude if such a result should arise from the discussion carried on in your columns. C. E.

*** This correspondence must now close.

NEW BY-LAWS FOR CONCRETE BUILDING IN THE METROPOLIS.

SIR,—With reference to the above, I beg to state that since you embodied a letter of mine in a leader in your valuable paper of October 2, 1869, I have erected in and about Southwark buildings in Portland cement concrete to the value of over 100,000*l.*,—some of these large warehouses let for as much as 1,000*l.* per annum, and stored with seed from floor to ceiling, to the height of 60 ft. This, I think, is allowed to be one of the most severe tests a building can have, and which my buildings have stood for several years without the slightest fracture.

In 1884 and 1885 I erected in Zoar-street, Southwark, two blocks of artisans' dwellings, one containing seventy, the other eighty, rooms. These, as well as the warehouses mentioned above, have all been built of London refuse (viz., broken bricks, stone chippings, slag and clinkers from furnaces and gas retorts, broken York flags, stone paving, with a small proportion of Thames sand).

There is more than enough of this refuse to erect buildings for the London poor. Why should it be carried miles out of the metropolis at a great cost as rubbish?

Why should we be forced to build houses of bricks when we have at our command abundance of this hard and incombustible material, procurable at little or no cost, with which we can erect walls known and proved to be less impervious to the atmospheric changes of our climate, than any other material that can be used for walling? Why do the Metropolitan Board, when at last forced to acknowledge concrete as a building material suitable for wall construction, seek by means of new laws to stamp it out! They do not come to see, or try to find out, if what has been done is bad; but make a new law which shall enforce the use of *one-third* more cement. This is certainly a prohibitory law.

The Metropolitan Board is a body elected to assist the public, not to stand in the way of the advancements of the age, because they will not give themselves the trouble to find out that which is good for them to know.

Fifteen years ago, I, after twelve months' delay, obtained from the Metropolitan Board the first licence for the erection of a concrete building granted in London. That licence ordered that the proportion of cement used should be *one to eight*, and it is in these proportions that all my work has been done. The walls stand wonderfully against all the steel tools and sledge-hammers that can be brought against them when alterations have been required, which I should be very pleased to show you, or any members of the Metropolitan Board, at any time. The proposed new by-laws state that the cement used shall be in the proportion of *one to five*, which means that this valuable London refuse shall still be carted away or carried out to sea, and shall not be used for building purposes.

Why is the system not more generally adopted? Because it is to the interest of so many connected with the building trade to stamp out that which is cheap and inexpensive. With labourers instead of bricklayers, and London refuse instead of bricks, no one has any idea how cheap walls may be erected.

Another great reason that this class of building has not advanced as the merits of the material would warrant, is the dreadful ordeal of red tape the

* Correspondents who write anonymously can hardly be called "ostentatious."—ED.

poor builder has to go through. For fifteen years I have been bound in this red tape, and when at last I break through my bonds by the decision of the Magistrate at the Southwark Police-court, on Sept. 9th, 1885 (published in the *Builder* of Sept. 19th, 1885), the Metropolitan Board attack me afresh with new laws, which, if passed, simply mean the stopping of concrete building in the Metropolis, and of the solving of the great problem "Housing the London poor."

H. GOODWIN.

P.S.—The Peabody Dwellings at Bermondsey are entirely of concrete.

The Student's Column.

FOUNDATIONS.—VII.

RIGHTS OF ADJOINING OWNERS.

IT will be convenient to consider in this place the effect that the vicinity of land or buildings, the property of other persons, has upon the foundations of a new building.

It appears to be thought by many persons that, in building on a town site where the owner desires to make the most of his land, he may put his footings or even his concrete partly upon his neighbour's land. It has even occurred that an owner has acted upon a belief that he can assume the willingness of his neighbour to allow a party-wall to be built upon the boundary line of the properties, and to pay in due time one-half the cost. However prudent or convenient that course may be to an adjoining owner in many cases, it must never be assumed that he will consent to it, and the foundation must, in the absence of a clear arrangement to the contrary, be made entirely upon the land of the building owner. A 9 in. wall built with footings and concrete, as required in the metropolis, will thus stand 8½ in. away from the boundary line, and that space will be wasted as also will a similar space adjoining it on the ground of the adjoining owner. There is, in fact, a waste of 2 ft. 2 in. in comparison with the result obtained by agreeing to build one 9 in. party-wall, and this consideration is usually sufficient to bring about an agreement between the parties.

But apart from considerations of waste of space, it is imprudent to build close up to your neighbour's land if it can be avoided, so that a house that is not intended to be built with its side walls made into party-walls should be kept well away from the boundary of the adjacent property. The adjoining owner may decide upon making a deep excavation on his land, either for building or for obtaining materials, and he may go to the full limit of his land so long as he does nothing that would cause his neighbour's land to fall in. But he is not bound to take any extra precautions that are rendered necessary by the extra weight of a new house on that land.

If you dig close to your neighbour's land you must take care that you do not let it fall into your excavation, nor any old house that is upon it.

A heavy building built upon a soil that is somewhat soft will by compressing the soil lower the foundation of an old house that stands near to it so as to cause the walls to crack. It is, therefore, advisable in such a case to carefully form the foundation on a deeper and more solid stratum, so that no settlement may occur. If, in order to do this the water has to be pumped out of the deeper excavation, this is very likely to cause subsidence and consequent damage to the building of an adjoining owner; but the law does not give him any remedy for the consequences of the abstraction of subsoil water. Foundations, like all other works, must be done according to law, and the above hints may prevent legal difficulties by inducing foresight and preventing works that are in dangerous proximity to adjoining property being done without proper consideration and advice.

Deep Foundations are required in exceptional cases, and in providing them ample space to execute the exceptional works is desirable. Where it is necessary to obtain a solid foundation in a stratum lying so deep below the surface that the building of walls in the ordinary way would be too costly or difficult, the work may be done in one of three ways. If the depth is not very excessive walls with very large openings may be built; for greater depths piers may be built at intervals along the course of the walls, but for very great depths some form of piling, a process quite distinct from anything that has been here described, must be used.

Walls with wide openings are put where the foundation has to be obtained, at about the depth of one story lower than the lowest story that is to be made useful in the building. The object is economy in brickwork, against which has to be set the cost of constructing the arches above the openings, and the inverted arches beneath them. The arches above the openings will be constructed with the ordinary precautions as to the relation of rise to span, and as to abutments, or girders may be used instead of arches. The arches below the openings are commonly made to a sweep of about one-third of a circle. The resistance of the earth against the end of each wall is a considerable advantage in the matter of abutment, but some sufficient abutment is as necessary for an inverted as for any other arch; therefore the piers at each end must be sufficiently large and the arch must not be too flat. The object of these inverts is to spread the weight of a building *over the whole length of the foundation* of its four walls, as the soil may not be so satisfactory as to justify reliance upon it if great weights should be thrown on particular spots.

Building upon piers is carried out by sinking a small number of shafts under the angles, and at wide intervals, along the course of the walls, and carrying up concrete and brickwork to the level of the floor of the lowest stay. Arches may be turned from pier to pier, with the ordinary precautions, and subject to the risks incidental to arched construction; but iron girders should as a rule be put (with or without relieving arches), so as to prevent the dangers of outward thrust. If the girders are buried in wet soil, cast-iron is, in such a situation, much more durable than wrought-iron. Sometimes the piers are carried up as high as the top of the lowest story, or the story above that, as in the cases where there is a basement below the ground-floor, and the piers are carried up to the level of the first floor. The walls that are necessary to enclose these stories may be built as thin as possible, and carried on a foundation of ordinary depth, if that should seem sufficient to carry them. In putting in the concrete for these piers (and all piers that have to carry considerable weight), great care must be taken to see that the bottom of the excavation is free from dirt or soft mud, as this would squeeze out under pressure, and the pier would sink to a very appreciable extent. In all such works, and, indeed, in all works that are below the level of the ground, it is highly desirable to build the brickwork in cement, or at least in hydraulic lime mortar.

In order to avoid the necessity for such deep foundations, the expedient, which has already been alluded to, of covering the whole site of a building with a substantial thickness of concrete, is sometimes adopted, and usually with success. But as there will probably be some settlement over the whole site, it is important to ascertain that the soft soil is pretty uniform in thickness throughout, or the building may settle down more on one side than on the other. If that seems a likely result, it is better to adopt some form of deep foundation that will be entirely reliable.

CHURCH-BUILDING NEWS.

Hernant.—It has been decided to build an entirely new church for the parish of Hernant, in the diocese of St. Asaph, and Mr. Lawrence Booth, F.R.I.B.A., of Manchester, has been commissioned to prepare the necessary plans and designs with a view to an early commencement of the work. The Earl of Powis, Sir Watkin W. Wynn, Mr. Bamford Hesketh, and other influential landowners, are giving their support to the movement, and Sir Watkin has promised to lay the corner-stone.

Bamber Bridge (*Lancashire*).—It is proposed to considerably enlarge and improve St. Saviour's Church, Bamber Bridge, near Preston, Lancashire, by erecting a new chancel, north and south transepts, organ-chamber and vestries, to take out the present square pews from the nave, and place new open pitch-pine benches, and to effect many other important improvements internally, from designs prepared by Mr. T. Harrison Myres, A.R.I.B.A. (Myres, Veevers, & Myres), of Preston, at a cost of over 3,000*l*.

Brockham.—An oak reredos, subscribed for by the parishioners, has lately been unveiled in Brockham Church, Surrey. The subject, which occupies a space of over 7 ft., is the "Last Supper," the figures being in high relief. The work has been designed and carried out by Messrs. Mayer & Co.

Liverpool.—St. James's Church, Marsh-lane, is an important addition to the churches of Liverpool, and was solemnly opened on Sunday, the 7th inst., after being some eighteen months in course of erection. It succeeds a smaller church, which has had to be removed, to give place to the extensive works of the Lancashire and Yorkshire Railway Company, and affords sitting accommodation for over 1,000 people. It consists in plan of nave and aisles, with tower and entrance at the south-west corner, a baptistery at the end of the north aisle, chancel and side chapels, with stone-vaulted ceilings, and a range of confessionals adjoining the tower and south aisle. On the south side are choir and clergy vestries, communicating with a commodious clergy-house. The total internal length is 148 ft., and the total breadth across the aisles within, 64 ft. The style is founded on a careful study of English church architecture of the Early Decorated period, dating about the middle of the thirteenth century, and the aim of the architects has been, while keeping closely to the character of the style, to design a building in every way suited to modern requirements, and to its individual position as a town church in a very populous district. With this view the external details are simply and broadly treated, undue ornamentation is avoided, and its lofty proportions and a long unbroken ridge from east to west make the church a landmark amongst the surrounding buildings. The materials are local red sandstone, and the roofs are covered with green Westmoreland slates. The nave has an arcade of six lofty arches, carried on alternately circular and octagonal columns, 25 ft. high. Above are coupled clearstory windows of two lights each, and the church is well lighted by windows in the aisle walls, placed at a good elevation above the floor, and by two five-light geometric windows in the nave and chancel gable walls, the sills of which are about 30 ft. from the ground. The nave has a panelled and arched ceiling, with massively moulded beams and rafters, the spaces between being plastered, and the floors are laid with 2-in. pitch-pine flooring, the chancel steps and footpaces being of encaustic tiles, by Messrs. Carter, Johnson, & Co., of Worcester. The interior proportions of the church are on the principle of the width and height forming the sides of an equilateral triangle. The heating is by low-pressure hot-water pipes, by Mr. C. Seward, of Preston, due care having been given to the subject of ventilation. The plans and details of the church have been prepared by Mr. C. Hadfield, of the firm of Messrs. E. Hadfield & Son, Sheffield, the preceding church of St. James being one of the earliest works of the late Mr. E. Hadfield. The contractors were Messrs. G. Woods & Son, Stanley-road, Bootle, for whom Mr. Bishop was foreman, Mr. William Haworth acting as clerk of the works.

John Hunter's House.—*Nature* publishes three small illustrations of some of the portions of John Hunter's house and grounds at Earl's Court, concerning which Dr. B. W. Richardson writes:—"The first drawing supplies the view of the house looking into the meadow, in which view the house is, I believe, nearly the same as it was when Hunter lived in it. The second sketch is that of the Lions' House or den, situated at the end of the meadow at the back, and to the right of the house, but quite visible from the windows. The Lions' House, as will be seen, is a raised mound of earth. The earth rests upon an arched structure, which, at the time of my last visit, was in an excellent condition, although ever since Hunter's time it has been a cowhouse, and has done nearly a century of useful service. At the top of the mound there is a little wall, of a circular shape, enclosing a small open space. The third sketch illustrates the famous copper in which the Irish giant was boiled to a skeleton. The space above the copper up to the flue from the roof is covered in, but two doors open in front above the mouth of the copper. The whole of this structure has remained in good preservation. The sketches are selected from views which Bertram Richardson has taken during the last autumn, as part of a series of homes and birthplaces of illustrious men."

RECENT PATENTS.

ABSTRACTS OF SPECIFICATIONS.

10,393, Ventilators. C. Lawrence and T. Wintour.

Relates to ventilators provided with wire gauze or other perforated surfaces, and consists in disposing the said surfaces in a direction inclined, preferably at an angle of about 45 per cent., to the surfaces to which they are applied, such latter surfaces preventing any direct through passage of the air.

13,213, Paving Blocks. A. Pimm.

The blocks, square or rectangular in cross section, are formed with a hole running through them longitudinally. From the surface, openings communicate with these internal passages, which are intended to serve as drains for rain-water. They are dowelled or bolted together, either over the whole surface of the road or over only a portion, forming wheel-tracks. They may be made of iron, concrete, or any sufficiently hard material. Specially formed blocks are used for flanged wheels, like those of tram-cars; in this case, if the groove is made in the centre of the block a strengthening rib is cast underneath it. Large flat blocks, having a number of parallel holes running through them side by side, are made for use between the wheel-tracks. The blocks may also be made reversible.

16,057, Cupboard Turn. J. Rhodes.

The cupboard turn is fixed by passing the slotted spindle through the door, and putting on first the washer, then the tongue fitting the square portions of the spindle, and finally the slotted cap, which, when screwed to the door, holds the tongue in place.

15,570, Drainage Flooring for Stables, &c. A. Ward.

The floor of the stable or stall slopes from the manger to the front, and also towards the sides, where longitudinal channels are provided, communicating in front with another channel, which may run the whole length of the stables.

16,192, Ventilating Billiard and other Rooms. Henderson and McNiel.

A flue in or near the ceiling is provided with branches or inlets at various parts, and opens to a chimney or upcast shaft. Within this flue, or attached to it, is a second flue also opening to the chimney, and provided with inlets having dome or cone shaped ends placed above the gas or oil burners employed for lighting the room. The products of combustion, in passing through the second flue, heat the air in the first flue, and thus produce an outflow of warm air from the room.

NEW APPLICATIONS FOR PATENTS.

Jan. 29.—1,319, J. Pickstock, Draught, Rain, and Dust Excluders.—1,322, L. Dettmer, Portable Electric Burglar Alarm.—1,325, R. Hunter and W. Moffatt, Cooking Ranges.—1,332, E. Hill, Supporting Window Sashes.

Jan. 30.—1,351, H. Holland, Preventing Down Draughts in Chimneys.—1,372, J. Watson and H. Moorwood, Dog Grates, Fireplaces, and Stoves.—1,380, J. Mazellet, Irons, Hinges, and Fastenings.—1,408, W. Webb, Ventilating Sewers, &c.

Feb. 1.—1,414, J. Haley, Glass Tiles.—1,416, J. Fletcher, Fasteners for Doors, &c.—1,452, J. Shepherd, Opening, Closing, or Adjusting Fanlights.—1,453, L. Sepulchre, Reflectors.—1,457, A. Tomkins and F. Cracknall, Heating Kilns.

Feb. 2.—1,491, R. Jenkins and J. Cox, Enamelled Coloured Plaster.—1,496, T. Crampton, Electric Bells.—1,513, T. Speight, Joiner's Bench Hooks.—1,534, A. Clark, Combination Locks.—1,546, A. Trew, Pipes for Sewers, Drains, &c.—1,553, W. Lake, Rock Drilling Tools.—1,557, W. Lake, Door Latches.

Feb. 3.—1,604, E. and A. Ashby, Cement Kilns.

Feb. 4.—1,650, E. Cameron, Holdfast Nail.—1,654, A. Gold, Hinges.—1,658, C. Smith, Mechanical Navvies.—1,663, T. Melvin, Floor Cloths and Tiles.—1,664, T. Wright, Socket Coupling for Pipes.

PROVISIONAL SPECIFICATIONS ACCEPTED.

15,112, J. Armistead, Ventilating Rooms, &c.—15,429, C. Clarke, Socketed Pipe Joints.—15,485, A. Smith, Heating Stoves.—15,630, L. Platnauer, Locks.—15,856, J. & W. Thompson, Slate or Glass Roofing.—15,877, J. Dejaiffe, Dressing, Polishing, and Squaring Stone.—16,012, J. Kenyon & J. Conlong, Water-closet.—16,076, B. Finch, Sanitary Pipes and Joints.—69, R. Stevens, Dry Gearing.—188, J. Mackenzie, Securing Metal Sash-bars in Roofs.—228, G. Hardingham, Lattice Bridges.—229, J. Hendra and W. Gooding, Stair Treads, Door Steps, Flooring, &c.—523, J. Smith, Automatic Electric Fire-Alarm.—15,097, C. McCarthy, Window Fastener.—15,625, F. Collins, Self-acting Bolt.—15,751, W. Joy, Charging Cement Kilns.—153, O. Elphick, Discharging Water from Flushing Cisterns.—157, J. Bennison, Curing Smoky Chimneys.—175, H. Haddan, Ventilators, Chimney and Smoke-stack Cowls.—210, J. Hargreaves, Gullies.—247, R. Bowman, Water Waste-preventer.—269, J. Barry, Pipe Tongs, Wrenches, &c.—405, H. Böhringer, Locks.

COMPLETE SPECIFICATIONS ACCEPTED.

Open to opposition for two months.

4,275, T. Oakley, Domestic Fire-grates.—4,413, H. Pepe, Securing Sliding Window-sashes and Shutters.—5,094, S. Sutcliffe, Tile Hearths and Tile Cheeks of Grates, &c.—5,264, E. Clowes, Hinges.—15,545, J. McConachy, Ventilators or Air Valves.—15,685, J. & T. Jennens, Pattern-maker's Cup Dowels.—4,131, H. Walker and J. Clark, Dust Bins.—4,668, W. Wilson, Ornamenting Wall Papers.—6,327, D. Rogers & Son, Fire-grates.—3, J. McKay, Disinfecting Apparatus.

RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

FEB. 1.

By HORNE, SON, & EVERSFIELD.

Hanover-square, Grosvenor-place—Profit rental of 228*l.* for three years	£400
Lambeth, Wandsworth-road—Rent charge of 100*l.* for 21 years	1,240

FEB. 2.

By DEBENHAM, TEWSON, & CO.

Berkhampstead, Herts — The residence called "White Hill," and 5½ acres, freehold	3,500

By SEDGWICK, SON, & WEALL.

Watford—61 to 67 odd, St. Alban's-road, freehold	785

FEB. 3.

By TOBIN & SONS.

Mile End-road—9 to 15 odd, Willow-street, 44 years, ground-rent 5*l.* 5s.	710

By A. & A. FIELD.

Camberwell—24 and 26, Tindal-street, 74 years, ground-rent 8*l.*	350

FEB. 4.

By GEORGE HEAD & CO.

Harewood-square—3, Melbury-terrace, 23 years, ground-rent 25*l.*	555

By DOUGLAS YOUNG.

South Lambeth—9, Thorne-street, 46 years, ground-rent 5*l.*	300

By WILKINSON & SON.

Brighton—44, Sussex-square, freehold	1,760

MEETINGS.

SATURDAY, FEBRUARY 13.

Architectural Association.—Visit to houses being erected in Collingham-road, South Kensington, from the designs of Messrs. George & Peto.

MONDAY, FEBRUARY 15.

Royal Institute of British Architects.—Mr. Alexander Beazeley, M. Inst. C.E., on "Swedish Building Law." 8 p.m.

Royal Academy of Arts.—Lectures on Sculpture: Mr. A. S. Murray on "The Works of Polykleitos and Lysippos." 8 p.m.

Victoria Institute.—The Rev. Canon Isaac Taylor on "The Hittite Monuments."—8 p.m.

Architectural Section of the Philosophical Society of Glasgow.—Mr. John Rennie on "Hydraulic Machinery for Buildings."

TUESDAY, FEBRUARY 16.

Royal Institution.—Professor C. T. Newton, C.B., on "The Unexhibited Portion of the Greek and Roman Sculptures in the British Museum." 3 p.m.

Institution of Civil Engineers.—Mr. L. F. Vernon-Harcourt on "The River Seine." 8 p.m.

Manchester Architectural Association.—Paper by Mr. J. S. Crowther. 7·30 p.m.

WEDNESDAY, FEBRUARY 17.

Carpenters' Hall, London Wall.—Mr. Thos. Blashill on "Timber, its Growth, Seasoning, and Preparation for Use." 8 p.m.

British Archæological Association.—Mr. J. Romilly-Allen on "Pre-Norman Stones at Keysham and Halton, Lancashire." 8 p.m.

Builders' Foremen and Clerks of Works' Institution.—Ordinary meeting. 8 30 p.m.

Society of Arts.—Prof. George Forbes on "Some Points in Electrical Distribution." 8 p.m.

THURSDAY, FEBRUARY 18.

Royal Academy of Arts.—Lectures on Architecture: Mr. G. F. Bodley, A.R.A., on "English Architecture of the Middle Age." 8 p.m.

Society for the Encouragement of the Fine Arts.—Mr. G. C. Haité on "The Tendencies of Modern Art." 8 p.m.

Royal Institution.—Professor Chandler Roberts-Austen, F.R.S., on "Metals as affected by small quantities of Impurity." 3 p.m.

Society of Antiquaries.—8·30 p.m.

York Architectural Association.—Mr. A. B. Burleigh on "Sanitary Engineering." 7·30 p.m.

Edinburgh Architectural Association.—Mr. W. Scott Morton on "Colour." 8·30 p.m.

FRIDAY, FEBRUARY 19.

University College.—Professor C. T. Newton, C.B., on "Greek Myths illustrated by Fictile Vases." 4 p.m.

Miscellanea.

Croydon Street Improvements.—The Corporation of the new borough of Croydon having advertised for designs and estimates for widening the three principal streets in the centre of the town, adjoining the Town-hall, twenty-four competitors entered the lists, and the result has been announced as follows:—First prize, 100*l.*, has been awarded to design marked "Fortuna," by Mr. J. M. Beydon; second prize, 50*l.*, to design marked "Ad Rem," by Messrs. J. D. Hayton and W. F. Potter; and third prize, 25*l.*, to design marked "Tria juncta in uno literatim."

Birkbeck Institution.—Mr. J. D. Cogan will deliver a lecture on Wednesday evening, February 17th, at the Birkbeck Institution, Chancery-lane, entitled "Pottery and Porcelain." The lecture, which will be historically and practically illustrated, will commence at eight o'clock.

Obituary.—We announce with much regret the death of Mr. Thomas Fraser, aged 72, a surveyor and clerk of works, who was killed on the North London Railway on the evening of the 5th inst. He was an old member of the Provident Institution of Builders' Foremen and Clerks of Works.——The death is announced of M. Loison, the well-known French sculptor, which took place suddenly last week at Cannes. The deceased artist, who was formerly a pupil of David d'Angers, executed a considerable number of works, several of which were purchased by the French Government.

The Earthquake as a Restoring Power. We are so in the habit of regarding the earthquake as an agent of destruction, that it may sound paradoxical to assert that the phenomenon is surpassed by no other as a regenerative and restorative agent. Yet this is strictly the case. But for earthquakes, our continents would continually,—however slowly,—diminish in extent through the action of the sea-waves upon their borders, and of rain and rivers on their interior surfaces. "Had the primeval world been constructed as it now exists," says Sir John Herschel, "time enough has elapsed, and force enough, directed to that end, has been in activity, to have long ago destroyed every vestige of land." It is to the reproductive energy of the earth's internal forces that we are alone indebted for the very existence of dry land. To the same cause, undoubtedly, we owe the gradual process of change in the configuration of continents and oceans which has been for ages and still is in progress,—a process the benefit derived from which cannot possibly be called in question. Our forests and our fields derive their nourishment from soils prepared, for long ages, beneath the waves of ocean; our stores of coal and of many other important minerals, have been in like manner prepared for our use during the long intervals of their submergence; we build our houses, even, with materials many of which owe their perfect adaptation to our wants to the manner in which they have been slowly deposited on what was once the bed of ocean, and compressed to a due solidity and firmness of texture beneath its depths.—*Mr. R. A. Proctor in "Knowledge" for February.*

Ancient Egyptian Textile Fabrics.—Herr Theodore Graf, of Vienna, who brought from Egypt the celebrated papyri, afterwards purchased by the Archduke Rainer, of Austria, has recently completed a fine collection of ancient Egyptian textile fabrics of wool and linen. He has obtained no less than 300 different specimens, which are all in an excellent state of preservation. They were procured from sepulchres, and represent the result of many years of labour in collecting and cleaning them. Every specimen is stitched upon a sheet of cardboard, and is protected from dust, &c., by fly-leaves. The size of the relics ranges from a foot square upwards. One of the largest and finest is an entire Roman toga, which is believed to be the only complete article of its kind that has been preserved from antiquity. The collection not only comprises many varieties of woven cloth, but also specimens of knitting, crewel, and needlework.

The Ventilation of Sewers.—There never will or can, we are convinced, be a final settlement of this issue until the absurd theories and devices of those who confound the behaviour of gas and vapour with that of water, and whose judgment is vitiated by other fallacies, have been utterly cast aside and abandoned. The particularly ridiculous notion that sewers can be ventilated by an arrangement which amounts to the construction of an inverted syphon,—the pure air to be drawn at the mouth of a low-level pipe, and the foul air ejected at the open mouth of a high-level pipe,—is probably one of the most mischievous and obstructive of prevailing misconceptions. As a matter of fact, there is only one way of effectually ventilating close drains and sewers, and that, happily, is an easy one. Pipes, which ought to be not less than 4 in. in diameter, as perpendicular as possible, and protected by a cowl at the summit, should be carried up from the drain or sewer to a point well above the level of the roofs of adjacent houses, and placed far away from chimneys. By means of these pipes the sewers may be properly ventilated. Sooner or later low-level or "surface" ventilators will be prohibited. We believe that to the agency of such apparatus, as disseminators of sewer gas, is to be ascribed much of the sickness which prevails in many localities.—*Lancet.*

Sanitary Assurance Association.—The fifth annual meeting of the Association was held at the Offices, 5, Argyll-place, Regent-street, on the 8th inst., Sir Joseph Fayrer, K.C.S.I., F.R.S., in the chair. The secretary, Mr. Joseph Hadley, read the annual report and balance-sheet. The report mentioned that "The properties inspected during the year have, as usual, been of the most varied character, including cottages and residences of every class in London and the country, also mercantile offices, trading premises, and institutions of a public character. In every case of first inspection the sanitary arrangements have been found to be more or less defective; but with newly-built property there has been a marked improvement, necessitating fewer alterations to secure the sanitary certificates." The income of the year was 462*l.* 1s. as against 310*l.* 17s. 9d. in 1884, and after meeting all liabilities, a balance was carried forward. Sir Joseph Fayrer proposed the adoption of the report. Professor Roger Smith, in seconding the motion, said that it was very satisfactory to hear of the improvement in newly-built property. This seemed to imply that the demand for houses with good sanitary arrangements was on the increase. Lord Fortescue, Dr. Danford Thomas, Lieut.-General Burne, Mr. Mark H. Judge, A.R.I.B.A., Mr. Andrew Stirling, Dr. Stevenson, and Mr. Kennett-Barrington spoke in support of the report, and it was adopted unanimously. Sir Joseph Fayrer and Mr. Henry Rutherfurd were re-elected, and Mr. Henry Currey, F.R.I.B.A., was elected member of the executive council. Sir Joseph Fayrer was re-elected President, and Professor Roger Smith was re-elected Vice-President of the Association for the ensuing year.

The Æolus Waterspray Ventilating Company have sent us three sheets of designs for casings for turret ventilators. The designs accord with various styles of work, and while hiding the naked unsightliness of the ventilators, the turrets are so planned as not to interfere with effectiveness of ventilation. The sheets will be found useful for reference. The Company have just received instructions to apply their complete system of heating, cooling, and ventilating to the Mary-street Memorial Schools, Taunton; to the Church of St. Barnabas, New Humberstone, Leicester; and to the Conservative Club, Birmingham.

The New Street from Piccadilly-circus to New Oxford-street.—The Works and General Purposes Committee of the Metropolitan Board of Works have decided to recommend the Board to name the new street from Piccadilly to Bloomsbury "Shaftesbury-avenue." As we have already observed (see p. 192, *ante*) there will be a certain appropriateness in the selection of this name, seeing that the Board has already granted a site in a prominent part of the new street for the erection of a statue to the late Lord Shaftesbury.

The Committee of the School of Art Wood Carving, which is now carried on at the Technical Institution, Exhibition-road, Kensington, have made arrangements to reduce the fees in the classes to students connected with the carving trade, thereby giving them an opportunity of advancing themselves in the knowledge of their business by studying under proper supervision and instruction a higher class of work than generally falls to the lot of apprentices snd improvers in the workshop.

Northumberland Avenue Hotel. — The American Elevator Company have just been awarded the contract for the hydraulic elevators for the Northumberland Avenue Hotel. They are to be four in number, and of the Standard hydraulic type. The water is to be furnished by means of a Worthington steam-pumping engine, so that the cost of working all four of these elevators will be simply the cost of fuel necessary to work the pump.

Wellington (Somerset).—Messrs. Bussell & Gibbs have just finished a series of stained leaded windows for the new woollen warehouses of Mr. Egerton Burnett. They consist of heraldic achievements in rich colours on a tinted ground, with coloured borders. They will be on view for the next few days at Messrs. Bussell & Gibbs's establishment, Wells-street, Oxford-street.

At St. Mary's Abbey, Mill Hill, a turret-clock, by Mr. J. W. Benson, of Ludgate-hill, has been erected by order of the Lady Abbess. The new clock shows time on a copper dial, 2 ft. 6 in. in diameter, striking the hours and chiming the quarters on two hemispherical bells.

Rating of Mining and Manufacturing Machinery.—The system adopted by many unions in the rating of the machinery at mines, iron, and other works, has long been looked upon as a serious grievance, but the trouble, annoyance, and cost of appealing have prevented those so taxed from appearing in court to test their liability. In some cases the plant and engines of all kinds, as well as the buildings, are valued and assessed. At works where there is a large expenditure of steam the engines are taxed for rating purposes, and this, as a rule, has been submitted to, for the reason already given. But we are glad to find that a change is now being made for the purpose of testing the question as to whether certain machinery is liable to be rated or not. The question, very properly, has been taken up by a most influential body, the Iron Trades Employers' Association. The appeal, in which the nominal appellants are Sir Joseph Whitworth & Co., of the Openshaw Works, near Manchester, will, of course, be fought out to the far end, regardless of expense, funds for that purpose being raised principally by the Lancashire members of the Association. The appeal was opened at the Salford Court of Sessions, when it was stated that the overseers had assessed the works on the rateable value of 8,327*l.*, and this included all the machinery which increased the value of the works as a going concern, and such as might be let in the event of their being transferred or sold. On the part of Sir Joseph Whitworth & Co. it was contended that the light machinery and tools, which might be considered movable, were not assessable, but only that portion which constituted the first motive power and was thoroughly affixed to the freehold. It was stated that the appellants were most anxious to have the case taken to the House of Lords for an authoritative and final decision. The result will be looked forward to with no ordinary interest by mine-owners and large users of steam power throughout the country, more especially those connected with the iron and engineering industries.—*Mining Journal.*

Conservation of Water.—Mr. Tarbotton, the Borough Engineer of Nottingham, in his report attached to the Report of the Water Committee for 1885, observes:—"Another point is the conservation of the water. I have so repeatedly referred to this, that I need not now enlarge upon it. I do not mean, for a moment, the restriction of delivery; on the contrary, the most reasonable and proper supply in all directions; but there is a great tendency on the part of the public to disregard the value of water, and the cost of obtaining it. Taps are allowed to run, in many cases, half their power; in multitudinous instances to dribble, and the aggregate of all these means a serious waste. I believe the waste inspectors are doing their duty, and there is a very vigilant inspection of all fittings, but still there is much loss which might be prevented. If the public would aid the Committee, by individually reporting defective fittings at the Water Office, either by a simple post-card, or by calling, they would contribute greatly to their own benefit. All taps are releathered at the cost of the department, and the effect of allowing water to escape without being properly used is to damage the houses externally and internally; to produce personal nuisance; to cause a wasteful expenditure of money, and to increase the cost of public water supply. There is no doubt that those who cause wanton or mischievous waste should be persistently punished, under the powers which the Corporation, with other corporations and companies, fully possess."

Building at Clapham.—There are few portions of the metropolitan suburbs where building has been going forward at a greater rate during the last few years than in that part of Battersea and Clapham in the immediate locality of Clapham Junction. It is computed that no fewer than 6,000 houses and shops have recently been erected in the neighbourhood. These are now being further increased by a large number of new residential buildings which are in course of erection on the St. John's Hill Estate. This estate, which extends from the foot of St. John's Hill, opposite Clapham Junction, to Battersea Rise on the south, and to a portion of Wandsworth Common on the west, and stretching to the boundary grounds of the Freemasons' Schools, was sold about twelve months ago for 16,000*l.*, and will shortly be covered with between four and five hundred houses.

The National Providence League for promoting universal insurance against destitution in sickness, infirmity, and old age is doing good work in calling attention to the subject of thrift, and the lessons of the present time of depression are likely to go a long way in enforcing attention to its proposals. In the *Reporter*, the quarterly organ of the League, there is a great deal of interesting matter bearing on the subject, including an address by Mr. James S. Randell (of the well-known firm of Randell & Saunders), who is a member of the Central Council of the League. Mr. Randell, in commencing his address, invited attention to the great effort in thrift that was being made, evidenced by the 92,000,000*l.* in the savings banks, by the large yearly contributions paid to friendly societies, and by the amounts paid to the industrial life insurance and burial societies. The savings of the industrial classes are large and important, and he expressed his regret that the large amounts invested in friendly societies and insurance societies did not work out for them the benefit to which the self-denial exercised entitled them. He maintained that the inadequacy of the present organisations was evidenced by the numbers who, notwithstanding all their thrift and self-denial, in their old age gravitated to the workhouse. Mr. Randall set before the meeting the organisation proposed by the Rev. Canon Blackley, that everyone should secure themselves against pauperism, and urged that the ages eighteen to twenty-one were those when a minimum provision for sickness and old age should be secured; that this minimum provision secured, and all fear of pauperism removed, would place each individual worker on a better platform for advancement in life; that they would then be in a better position to secure to themselves further protections, either by entering on sound friendly societies with payments arranged on the honest basis of the members having all they pay for, or other sound investment of their savings; and concluded with the observation, that in the organisations proposed by the Rev. Canon Blackley stability is assured.

Dunfermline.—The new High School at Dunfermline was opened on the 5th inst. Messrs. Holme & Mercer, of Liverpool, are the architects, and Mr. W. Swinton fulfilled the duties of master of works. The contractors for the various works were:—Mr. George Dick, for mason's work; Messrs. Mitchell & Kinghorn, for joiner's work; Mr. A. Rolland, for plumber's and gasfitter's work; Messrs. M'Ouan & Lambert, for slater's work; Messrs. A. & R. M'Gregor, for plasterer's work; Messrs. Bennett & Son, for ironwork; Mr. A. Lowe, for glazier's work,—all of Dunfermline; Messrs. Stuart & Co., Edinburgh, for granolithic work; Messrs. Robinson & Son, Edinburgh, for heating work; Mr. Roger Lowe, Farnworth, for wood-block flooring work; Mr. Hooper, Glasgow, for ornamental glass work; Mr. Stevens, Leeds, for ventilation extractors; Mr. H. Thompson, Birkenhead, for gasfittings; Mr. James Roy, Liverpool, for grates and stoves; and Messrs. Bonnar & Sons, Dunfermline, for ornamental ironwork, railings, gates, &c. The carving was done by Mr. W. Neilson, Edinburgh. The measurer was Mr. A. Lawrie, George-street, Edinburgh. A view of the school was published in the *Builder* for Nov. 14 last.

Association of Public Sanitary Inspectors.—At the usual monthly meeting of the Association, held on Saturday last, a paper was read by Mr. Buckworth (St. Saviour's District Board) on the legislation regulating the preparation and sale of "Food and Drugs." The paper concluded by pointing out that the public analyst was now far more in request than formerly. A discussion followed, in which the Chairman (Mr. Jerram, C.E.), and Messrs. Rains, Alexander, Fisher, Hall, and others took part. Most of the speakers complained that the Act was rendered almost inoperative through the leniency of magistrates, who inflicted fines ridiculously small in amount; and some of them were of opinion that officials other than the sanitary inspector should be charged with the duty of carrying out the Act.

"A Large Gasholder."—We are asked to mention that the gasholder for the Imperial Continental Gas Association's works at Erdberg is a "triple-lift telescope," and that it has been designed and is in course of construction by Messrs. C. & W. Walker, of the Midland Iron Works, Donnington, near Newport, Salop. The tank and the building which will cover the holder are already completed.

A Substitute for Glass.—We have received a sample of a new material, which is easily applied to framed roofs or windows, in lieu of glass, and which has just been introduced. It consists of wire gauze of ⅛ in. mesh, coated with elastic varnish to cover the wires and close the meshes. The varnish can be tinted without affecting its transparency, and we are informed that roofs constructed with it are not liable to expansion and contraction like glass roofs. Two factories for its manufacture have been erected at Willesden, by Messrs. North & Son, of London-road, Southwark, and St. Bride-street, Ludgate-circus. We are informed, in answer to inquiries, that the varnish is not soluble by rain, nor liable to crack by the heat of the sun. It is said to have been used with satisfactory results, and so satisfied are the patentees of the enduring qualities of the material, that they are laying down extensive plant for its manufacture. It possesses the advantage of being much lighter than glass.

PRICES CURRENT OF MATERIALS.

TIMBER.	£. s. d.	£. s. d.
Greenheart, B.G. ....ton	6 10 0	7 10 0
Teak, E.I. ....load	12 10 0	15 10 0
Sequoia, U.S. ....ft. cube	0 2 4	0 2 6
Ash, Canada ....load	3 0 0	4 10 0
Birch "	3 0 0	4 10 0
Elm "	3 10 0	4 15 0
Fir, Dantsic, &c.	1 10 0	4 10 0
Oak "	3 0 0	5 0 0
Canada	5 10 0	6 10 0
Pine, Canada red	3 0 0	4 0 0
" yellow	3 0 0	5 0 0
Lath, Dantsic ....fathom	3 10 0	5 0 0
St. Petersburg	4 0 0	6 0 0
Wainscot, Riga ....log	2 15 0	4 10 0
" Odessa, crown	3 12 6	3 15 0
Deals, Finland, 2nd and 1st...std. 100	7 10 0	8 10 0
" 4th and 3rd	6 0 0	7 10 0
Riga	6 0 0	8 0 0
St. Petersburg, 1st yel.	9 0 0	14 0 0
" 2nd "	7 0 0	8 15 0
" white	7 0 0	10 0 0
Swedish	6 0 0	15 0 0
White Sea	7 0 0	17 10 0
Canada, Pine 1st	17 0 0	30 0 0
" 2nd	12 0 0	17 0 0
" 3rd, &c.	6 0 0	10 0 0
" Spruce 1st	8 0 0	11 0 0
" 3rd and 2nd	5 0 0	7 10 0
New Brunswick, &c.	5 0 0	7 0 0
Battens, all kinds	4 0 0	12 0 0
Flooring Boards, sq. 1 in.—Prepared, first	0 9 0	0 13 0
Second	0 7 6	0 8 6
Other qualities	0 5 0	0 7 0
Cedar, Cuba ....foot	0 0 3½	0 0 4
Honduras, &c.	0 0 3	0 0 4
Australian	0 0 2½	0 0 3
Mahogany, Cuba	0 0 5	0 0 7½
St. Domingo, cargo av.	0 0 5	0 0 7½
Mexican "	0 0 3½	0 0 4½
Tobasco cargo av.	0 0 4	0 0 6½
Honduras cargo av.	0 0 4½	0 0 6½
Maple, Bird's eye	0 0 3½	0 0 6
Rose, Rio ....ton	7 0 0	16 0 0
Bahia	8 0 0	14 0 0
Box, Turkey	5 0 0	18 0 0
Satin, St. Domingo .... ft.	0 0 0	0 0 0
Porto Rico	0 0 0	0 0 0
Walnut, Italian	0 0 4	0 0 5

METALS.		
IRON—Pig in Scotland ....ton	2 2 6	0 0 0
Bar, Welsh, in London	4 15 0	5 0 0
" " in Wales	4 7 6	4 10 0
" Staffordshire, London	5 15 0	7 0 0
Sheets, single, in London	7 10 0	9 0 0
Hoops "	6 5 0	7 5 0
Nail-rods "	5 15 0	7 0 0
COPPER—		
British, cke. and ingt. ....ton	42 0 0	44 0 0
Best selected	44 0 0	45 0 0
Sheets, strong	50 0 0	0 0 0
" India	48 0 0	48 10 0
Australian, fine cash	0 0 0	0 0 0
Chili, bars	47 0 0	40 10 0
YELLOW METAL "	12 7 6	12 10 0
LEAD—Pig, Spanish ....lb.	0 0 4 3/16	0 0 4½
English, com. brands	12 15 0	12 17 6
Sheet, English	13 12 6	13 17 6
SPELTER—		
Silesian, special ....ton	15 5 0	15 7 6
Ordinary brands	15 0 0	15 2 6
TIN—		
Banca	0 0 0	0 0 0
Billiton	0 0 0	0 0 0
Straits	93 0 0	93 10 0
Australian	93 2 6	93 12 6
English ingots	97 0 0	0 0 0
ZINC—		
English sheet ....ton	17 0 0	17 15 0

OILS.		
Linseed ....ton	19 10 0	19 17 6
Cocoanut, Cochin	29 10 0	30 0 0
Ceylon	26 0 0	0 0 0
Copra	13 10 0	15 5 0
Palm, Lagos	29 0 0	29 10 0
Palm-nut Kernel	25 0 0	0 0 0
Rapeseed, English pale	22 15 0	0 0 0
" brown	21 0 0	0 0 0
Cottonseed, refined	17 15 0	19 0 0
Tallow and Oleine	25 0 0	40 0 0
Lubricating, U.S.	6 0 0	10 0 0
" Refined	10 0 0	13 0 0
TURPENTINE—		
American, in cks. ....cwt.	1 7 3	1 7 6
TAR—Stockholm ....brl.	0 19 0	0 19 6
Archangel	0 12 0	0 12 6

COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

Epitome of Advertisements in this Number.

COMPETITIONS.

Nature of Work.	By whom required.	Premium.	Designs to be delivered.	Page.
Public Library, &c.	Folkestone Town Cncl.	50*l.*	March 1st	ii.
Municipal Buildings	Sunderland Corporation	Not stated	Not stated	ii.

CONTRACTS.

Nature of Work, or Materials.	By whom required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.	Page.
New Cattle Markets	St. Ives Corporation ...	E. W. Robb	Feb 15th	ii.
Timber and Scaffold Poles	India Office	*Official*	Feb. 16th	ii.
Additions, &c., to Station Buildings, Bilton..	North Eastern Railway	W. Bell	Feb. 17th	ii.
Works and Materials	Kingston Highway Brd.	A. J. Henderson	do.	xiii.
Drainage Works	St. George's, Hanover-square, Burial Brd.	A. J. Bolton	Feb. 22nd	ii.
New Sorting Office, Hornsey	Com. of H.M. Works...	*Official*	do.	ii.
Works and Materials	Vestry of St. Giles, Camberwell	do.	do.	xiii.
General Works to Sewers and Drains....	do.	do.	Feb. 23rd	xiii.
Materials and Works	Willesden Local Board	O. Claude Robson	do.	xiii.
Hospital, Liscard	Wallasey Local Board	A. Salmon	do.	xiii.
Hospital, Winchester	Winchester Corporation	J. Colson & Son	Feb. 24th	xiii.
Additional Buildings to Workhouse	West Ham Union	*Official*	do.	ii.
Drying-Horses and Airing-Room in Laundry	Guardians St. Leonard, Shoreditch	J. W. Peggs	do.	xiii.
Road-making, Tar-paving, &c.	Kensington and Chelsea School District	A. & C. Harston	Feb. 25th	ii.
Works and Materials	Vestry of St. Mary, Islington	*Official*	Feb. 26th	xiii.
Works and Materials	Surbiton Imp. Com. ...	do.	Feb. 27th	ii.
Improvement of King's-road, Brighton	Brighton Town Council	P. C. Lockwood	March 2nd	ii.
Footway Repairs	Bromley Local Board...	*Official*	do.	xiii.
Works, Repairs, and Supply of Materials....	War Department.....	do.	March 8th	ii.
Stoneware Sewer-Pipes and Gully Traps	Bath U. S. A.	C. R. Fortune....	do.	xiii.
Waterworks	Rotherham Corporation	Jas. Mansergh	March 24th	ii.
Wood Paving	Norwich Corporation ...	*Official*	Not stated	ii.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.	Page.
Clerk of Works	Chelsea Vestry.....	2*l.* 10s. per week ...	Feb. 17th	xvi.
District Road Surveyor	Liverpool Corporation	160*l.*	Feb. 24th	xvi.
Surveyor and Assistant Surveyor....	Fulham Vestry.....	300*l.* and 100*l.*	Feb. 25th	xvi.
Rating Surveyor and Valuer	Faversham Union	Not stated	March 4th	xvi.

TENDERS.

ACTON.—For rebuilding Nos. 2, 3, and 4, The Hill, Acton. Messrs. N. S. Joseph & Smithem, architects:—

G. S. Pritchard & Son	£2,448 0 0
Patman & Fotheringham	2,373 0 0
Waters, Ealing	2,345 0 0
Myring, Ealing	2,270 0 0
Gregory & Co., Clapham	2,257 0 0
Bray, Acton (accepted)	2,050 0 0

BEXHILL-ON-SEA.—For sewerage works. Mr. H. B. Nichols, C.E., engineer, Grosvenor-chambers, Corporation-street, Birmingham. Quantities supplied:—

Thos. Rigby, Croydon	£7,675 0 0
Hilton & Sons, Birmingham	7,393 0 0
Wiswell, London	6,944 0 0
Foster & Barry, Radcliffe-on-Trent..	6,927 0 0
J. W. Webb, Brockley	6,770 0 0
Jno. Piper, Hastings	6,745 0 0
Woodham & Fry, Greenwich	6,697 0 0
John White, Handsworth, Birmingham	6,600 0 0
Cowdray & Sons, Newent, Gloucester	6,514 0 0
Fredk. Cruttenden, St. Leonards ...	6,487 0 0
Neve, Leytonstone	6,440 0 0
Thos. Todd & Co., Bexhill-on-Sea ...	6,394 0 0
John Jevons, Dudley	6,355 0 0
Thos. Adams, Moorgate-st., London.	6,100 0 0
Wm. Cunliffe, Barking	6,084 0 0
Innes & Wood, Birmingham....	5,978 12 6
Leon. Bottoms, Battersea....	5,969 0 0
Alf. King, Hollington, Sussex	5,875 0 0
Jas. Cole, Bexhill-on-Sea	5,845 0 0
H. Saunders, Westminster	5,642 0 0
J. Hayward, Eastbourne (accepted).	5,477 0 0
Thos. Simmonds, Skegness	5,452 0 0
Marshall, Brighton	5,376 0 0
Alf. Palmer, Birmingham....	5,375 0 0

[Engineer's estimate, 5,690*l.*]

BROMLEY (Kent).—For alterations and additions to Science and Art Schools, for the Committee. Messrs. Potts, Sulman, & Hennings, architects. Quantities by Mr. Geo. Fleetwood:—

W. Brass & Son	£1,350 0 0
J. & C. Bowyer....	1,320 0 0
Staines & Son	1,276 0 0
Grubb	1,255 0 0
Arnaud	1,242 0 0
Lemon	1,236 9 6
Nash....	1,215 0 0
Parker	1,200 0 0
Balding	1,198 0 0
Tyerman	1,195 0 0
Crossley	1,193 0 0
Lane....	1,188 0 0
Grist	1,183 0 0
Castle	1,170 0 0
Manly	1,167 0 0
Lorden & Son, Upper Tooting *	1,149 15 0

* Accepted.

BURY ST. EDMUNDS.—For new shop and residence, Cornhill, Bury St. Edmunds, for Mr. D. Thomas. Mr. J. Codd, architect:—

J. Robinson, jun., Bury....	£2,234 0 0
Mason & Sons, Haverhill	2,054 0 0
J. Robinson, sen., Bury....	2,030 0 0
A. H. Hanchet, Bury	2,025 0 0
Everett & Sons, Colchester	1,975 0 0
F. Tooke, Bury....	1,929 0 0
Shillitoe & Son, Bury	1,925 0 0

CHATHAM.—For the erection of villa residence, Maidstone-road, Chatham, for Mr. Edward Davies. Mr. G. E. Bond, architect:—

Leagars, Chatham	£780 0 0
Darby, Rochester....	704 10 0
Edsen & Bockham, Chatham	694 0 0
Bathurst Bros., Rochester	625 0 0
Sampson, Chatham	599 0 0
Heaven, Rochester (accepted)	540 0 0

CHELTENHAM.—For certain intended alterations and additions to the Union Workhouse and the Elms, for the Guardians of the Cheltenham Union. Mr. Darby, architect, Cheltenham. Quantities by Mr. Darby and Mr. Place, Cheltenham:—

For the whole of the work, comprising Division No. 1, the Administrative Block; No. 2, Chapel; No. 3, Male and Female Infirmaries; No. 4, Master's House and Laundry; and No. 5, The Elms:—

E. Meredith, Gloucester	£13,313 0 0
C. Claridge, Banbury	12,549 0 0
W. Fream, jun., Gloucester	12,208 0 0
G. Drew & Sons, Chalford	12,194 12 9
Wm. Scamell, Cheltenham	12,113 0 0
W. Jones, Gloucester	11,790 0 0
Stephens & Bastow, Bristol....	11,430 0 0
D. C. Jones & Co., Gloucester	11,403 0 0
C. H. Rainger, Cheltenham....	11,362 0 0
H. Hilton & Sons, Birmingham	11,203 0 0
J. Jones & Sons, Sedgley....	11,000 0 0
A. King, Gloucester	10,828 0 0
T. Collins, Tewkesbury....	10,681 0 0
For Divisions 1, 2, *and* 3.	
A. C. & S. Billings, Cheltenham ...	10,761 0 0
For Division 1, 2, 3, *and* 5.	
Humphris & Co., Cheltenham	11,628 0 0
For Division 1, 4, *and* 5.	
W. C. Channon, Cheltenham....	4,469 0 0

CROYDON.—For the erection of additional stabling, for Messrs. Carter, Paterson, & Co., at their Depôt, Handcroft-road, under the superintendence of Mr. W. Eve, Union-court, Old Broad-street:—

Maides & Harper....	£397 0 0
Holland	383 0 0
Harris & Wardrop	377 0 0
Exton	312 0 0
Docking....	305 10 0
Higgs, Station Works, Loughborough Junction (accepted)	294 0 0

LEICESTER.—For excavating and removing between 3,000 and 4,000 cubic yards of soil, and depositing the same in the old clay pits between Regent's-road and Lancaster-street, for the Estate Committee of the Corporation of Leicester. Mr. J. Gordon, C.E., borough surveyor:—

	Per sq. yd.	Per cube yd.
Jos. Allsopp, Leicester*	3d.	10d.
J. Smith, Belgrave, Leicester.	3d.	11½d.
Innes & Wood, Birmingham...	6d.	1s. 2d.
T. H. Selvidge, Leicester	6d.	1s. 3d.
E. Tempest, Keighley (Yorks)	6d.	1s. 3d.
B. W. Ward, Whetstone (Leicestershire)	7½d.	10d.

* Accepted.

LONDON.—For repairs and decorations at St. Stephen's Church, Coleman-street, City. Mr. J. Ebenezer Saunders, architect:—

Colls....	£347 0 0
Smith	275 0 0
Heeps (accepted)....	247 0 0

LONDON.—For extension of St. George's-in-the-East Workhouse and Infirmary, Princes-street, Old Gravel-lane, for the Guardians of the Poor of the Parish of St. George-in-the-East Messrs. Wilson, Son, & Aldwinckle, architects, East India-avenue. Quantities supplied:—

F. R. Tozer	£15,971	0	0
John Curnow	15,5 0	0	0
W. L. Kellaway	14,967	0	0
W. J. Hack	14,484	0	0
G. & J. Green	14,300	0	0
Staines & Son	14,280	0	0
Balaam & Co.	14,150	0	0
F. & F. J. Wood	13,950	0	0
Samuel Chafen	13,900	0	0
J. Hearle & Son	13,783	0	0
W. F. Croaker	13,449	0	0
J. Walker	13,442	0	0
W. Johnson	13,343	0	0
J. T. Chappell	13,113	0	0
Harris & Wardrop	12,973	0	0
H. Hart	12,784	0	0
W. Brass & Son	12,777	0	0
Kirk & Randall	12,634	0	0
G. W. Wyatt & Co.	12,244	0	0
Charles Cox (accepted)	11,990	0	0
M. A. Palmer & Co.	10,899	0	0

LONDON.—For proposed Artisans' Dwellings, Cartwright-street, Whitechapel, for Mr. Alfred C. de Rothschild. Messrs. Wilson, Son, & Aldwinckle, architects, 2, East India-avenue, Leadenhall-street. Quantities supplied:—

Conder	£9,853	0	0
Mount	9,780	0	0
Hall, Beddall, & Co.	9,686	0	0
Bywaters	9,054	0	0
Kirk & Randall	8,387	0	0
Sparks	7,484	0	0

LONDON.—For pulling down and rebuilding No. 106, Drury-lane, and No. 1, Clare-court. Mr. A. J. Bolton, architect. Quantities supplied:—

Macfarlane & Son	£1,429	0	0
Manley	1,422	0	0
Beale	1,368	0	0
Gentry	1,350	0	0
Macey & Son	1,298	0	0
Williams & Son	1,274	0	0
Seawen	1,274	0	0
Marsland & Son	1,260	0	0
G. Parker (accepted)	1,229	0	0

LONDON.—For repairs, &c., to the Britannia public-house, Latimer-road, Notting-hill, for Mr. Edmonds. Mr. H. I. Newton, architect, Queen Anne's Gate:—

Riddle	£660	0	0
Cook	521	0	0
Spencer & Co.	400	0	0
Burman & Son	377	0	0
Steel Bros. (accepted)	375	0	0

LONDON.—For building workshop at the rear of 165, Pentonville-road, for Mr. H. E. Trowse. Messrs. Watson & Soames, architects, Nottingham-place:—

Barnford	£375	0	0
Cowper	370	0	0
Turner	361	0	0
Riley Bros. (accepted)	349	0	0

ORPINGTON (Kent).—For erecting four cottages, Broom-hill. Mr. F. J. Chambers, architect:—

Lorden & Son, Upper Tooting (accepted)	£850	0	0

RICHMOND (Surrey).—For foreman's cottage, stores, &c., in the Parish-yard. Mr. W. Brooke, A.M.Inst.C.E., Town Surveyor. Quantities by Mr. C. M. Houghton, surveyor, Portsmouth:—

C. Eldridge, Richmond	£1,450	0	0!
Sweet & Loder, Richmond	794	0	0
J. G. B. Marshall, Brighton	720	0	0
C. Maton, Kew	690	0	0
Peirce & Lansdowne, Richmond	679	0	0
F. Sims, Richmond (accepted)	675	0	0!

[Surveyor's estimate, 735*l.*]

RICHMOND (Surrey).—For additional stabling in the Parish-yard. Mr. Walter Brooke, Town Surveyor:—

C. Eldridge, Richmond	£450	0	0!
J. G. B. Marshall, Brighton	161	0	0
F. Sims, Richmond	155	0	0
Sweet & Loder, Richmond	127	0	0
Peirce & Lansdown, Richmond	126	0	0
C. Maton, Kew (accepted)	123	0	0!

[Surveyor's estimate, 135*l.*]

STOCKTON.—For the construction of reservoirs for the Stockton and Middlesbrough Water Board:—

Contract No. 8.—Fighting Cocks Reservoir.

Thos. Hunt, South Stockton	£7,717	9	9
Robert Wilkinson, Middlesbrough	6,767	19	9
Jonathan Vickers, Bishop Auckland	6,461	14	0
Foster & Barry, Radcliffe-on-Trent	5,884	14	9
Walker & Dickinson, Saltburn	5,791	4	1
William Kitching, Fighting Cocks	5,189	1	3
T. D. Ridley, Middlesbrough	5,158	3	6
Charles Firth, Scarborough	5,129	11	8
S. W. Pilling & Co., Manchester	5,072	9	0
Abram Kellett, Ealing, Middlesex	4,848	12	10
John Jackson, Westminster	4,697	3	10
E. H. & G. Allison, Sunderland	4,638	19	3
W. C. Atkinson, Stockton	4,506	2	4
John Wood & Son, Leeds	4,393	9	4
George Marshall, Darlington	4,257	4	1

Contract No. 9.—Sadberge Reservoir.

Thos. Hunt, South Stockton	£27,647	13	4
W. C. Atkinson, Stockton	23,069	15	6
Robt. Wilkinson, Middlesbrough	22,311	5	0
Parker & Sharpe, Batley	20,259	13	6
Foster & Barry, Radcliffe-on-Trent	19,856	18	4
T. D. Ridley, Middlesbrough	19,503	9	0
Abram Kellet, Ealing	17,709	9	3
S. W. Pilling & Co, Manchester	17,616	1	4
Jno. Jackson, Westminster	17,325	2	7
Walker & Dickinson, Saltburn	16,632	10	9
E. H. & G. Allison, Sunderland	16,557	0	3
Jno. Wood & Son, Leeds	16,167	19	10
Geo. Marshall, Darlington	16,012	9	6
Jno. Johnson & Son, Middlesbrough	15,744	3	9

SPECIAL NOTICE.—Lists of Tenders frequently reach us too late for insertion. They should be delivered at our office, 46, Catherine-street, W.C., *not later than Four p.m.* on THURSDAYS.

TO CORRESPONDENTS.

Registered Telegraphic Address, "THE BUILDER, LONDON."

W. S. (we fail to see the analogy).—"Electric Light on the Stage" (the arrangement was carried out long ago at the Savoy Theatre, in its main points).—S. H.—M. & Co.—A. R. & Co.—H. J. W. (your proposition is what no architects in this world would ever assent to, and we cannot see anything to be gained by printing unpracticable proposals).—C. H.

All statements of facts, lists of tenders, &c., must be accompanied by the name and address of the sender, not necessarily for publication.

We are compelled to decline pointing out books and giving addresses.

NOTE.—The responsibility of signed articles, and papers read at public meetings, rests, of course, with the authors.

We cannot undertake to return rejected communications.

Letters or communications (beyond mere news-items) which have been duplicated for other journals, are NOT DESIRED.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; all communications relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

PUBLISHER'S NOTICES.

Registered Telegraphic Address, "THE BUILDER, LONDON."

CHARGES FOR ADVERTISEMENTS.

SITUATIONS VACANT, PARTNERSHIPS, APPRENTICESHIPS, TRADE, AND GENERAL ADVERTISEMENTS.

Six lines (about fifty words) or under ..... 4s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

Terms for Series of Trade Advertisements, also for special Advertisements on front page, Competitions, Contracts, Sales by Auction, &c. may be obtained on application to the Publisher.

SITUATIONS WANTED.

FOUR Lines (about THIRTY words) or under ..... 2s. 6d.
Each additional line (about ten words) ..... 0s. 6d.

PREPAYMENT IS ABSOLUTELY NECESSARY.

*** Stamps *must not* be sent, but all small sums should be remitted by Cash in Registered Letter or by Money Order, payable at the Post-office, Covent-garden, W.C. to

DOUGLAS FOURDRINIER, Publisher,
Addressed to No. 46, Catherine-street, W.C.

Advertisements for the current week's issue must reach the Office before THREE o'clock p.m. on THURSDAY.

The Publisher cannot be responsible for DRAWINGS, TESTIMONIALS, &c. left at the Office in reply to Advertisements, and strongly recommends that of the latter COPIES ONLY should be sent.

SPECIAL.—ALTERATIONS in STANDING ADVERTISEMENTS or ORDERS TO DISCONTINUE same, must reach the Office before TEN o'clock on WEDNESDAY mornings.

PERSONS Advertising in "The Builder," may have *Replies addressed to the Office,* 46, Catherine-street Covent Garden, W.C. *free of charge.* Letters will be forwarded if addressed envelopes are sent, together with sufficient stamps to cover the postage.

TERMS OF SUBSCRIPTION.

"THE BUILDER" is supplied DIRECT from the Office to residents in any part of the United Kingdom at the rate of 19s. per annum PREPAID. To all parts of Europe, America, Australia, and New Zealand, 26s. per annum. To India, China, Ceylon, &c. 30s. per annum. Remittances payable to DOUGLAS FOURDRINIER, Publisher, No. 46, Catherine-street, W.C.

Best Bath Stone, for Winter use.
WESTWOOD GROUND,
Box Ground,
Combe Down,
Corsham Down, and Farleigh Down. { Summer / Dried.
RANDELL, SAUNDERS, & CO., Limited,
Corsham, Wilts. [ADVT.

Box Ground Stone
is the best for use in all exposed positions being a well-known and tried Weather Stone.
50,000 ft. cube in stock.
PICTOR & SONS,
BOX, S.O., WILTS. [ADVT.

Doulting Freestone.
THE CHELYNCH STONE. { The stone from these quarries is known as the "Weather Beds," and is of a very crystalline nature, and undoubtedly one of the most durable stones in England.
THE BRAMBLEDITCH STONE. { Is of the same crystalline nature as the Chelynch Stone, but finer in texture, and more suitable for fine moulded work.
HAM HILL STONE.
Greater facilities have been provided for working these quarries, and the stone can be supplied in large quantities at short notice.
Prices, and every information given, on application to CHARLES TRASK & SONS, Norton-sub-Hamdon, near Ilminster, Somerset.
London Agent — Mr. E. WILLIAMS,
16, Craven-street, Strand, W.C. [ADVT.

Doulting Free Stone
HAM HILL STONE,
BLUE LIAS LIME
(Ground or Lump),
For prices, &c., address S. & J. STAPLE, Quarry Owners, Stone and Lime Merchants, Stoke-under-Ham, Ilminster. [ADVT.

Ham Hill Stone! Ham Hill Stone!!!
For Ham Hill Stone of best quality and workmanship, apply to JOHN HANN & SON, Quarry Owners, Montacute, Ilminster. Established 1837. Agents, MATTHEWS & GEARD, Albany Wharf, Regent's Park Basin, N.W. [ADVT.

Asphalte.—The Seyssel and Metallic Lava Asphalte Company (Mr. H. Glenn), Office, 38, Poultry, E.C.—The best and cheapest materials for damp courses, railway arches, warehouse floors, flat roofs, stables, cow-sheds, and milk-rooms, granaries, tun-rooms, and terraces. [ADVT.

Asphalte.
Seyssel, Patent Metallic Lava, and White Asphaltes.
M. STODART & CO.
Office:
No. 90, Cannon-street, E.C. [ADVT.

EVERY DESCRIPTION OF SEASONED WOODS AND VENEERS IN EXTENSIVE QUANTITIES.

B. J. HUDSON & SONS,
Millbank Sawmills, Grosvenor-road, S.W.;
Whitfield-street, W.;
And Store-street, London, W.C.
Telephone No. 3,152, and Private Wire connecting Business Premises.

BANNER VENTILATORS.

The Strongest Exhaust Ventilators for all Buildings, Public Halls, Churches, Billiard-Rooms, &c.

HIGHEST PRIZES at all the most important Exhibitions.

BANNER SYSTEM OF SANITATION AND SANITARY APPLIANCES
WERE AWARDED AT THE
International Health Exhibition, 1884, One Gold Medal, Three Silver Medals, and One Bronze.

For further Particulars and Prices apply to

BANNER BROS. & CO. Sanitary and Ventilating Engineers,
11, BILLITER SQUARE, LONDON, E.C.